International Polar Orbiter Processing Package (IPOPP) User's Guide

Version 1.7a

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GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

International Polar Orbiter Processing Package (IPOPP)

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General

The NASA Goddard Space Flight Center's (GSFC) Direct Readout Laboratory (DRL), Code 606.3 developed this software for the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) In-Situ Ground System (NISGS) and the International Polar Orbiter Processing Package (IPOPP). The IPOPP package leverages NISGS technologies to maximize the utility of Earth science data for making real-time decisions by giving fast access to instrument data and derivative products from the Aqua and Terra missions and future NPP and NPOESS missions.

This software is provided to Alpha Testers under an Alpha test agreement and cannot be redistributed. Alpha testers should be aware that development of this preliminary software continues. The DRL welcomes feedback from Alpha testers as this software further evolves. Please direct any comments or questions regarding this software to the DRL via the "Contact Us" mechanism at the DRL Web Portal:

http://directreadout.sci.gsfc.nasa.gov/index.cfm?section=contact us

Purpose

This document provides instruction for installing and operating the IPOPP software. The installed system as currently configured reads MODIS Level-0 Production Data Set (PDS) (packet file and Construction Record [CSR]) file pairs and generates Level-1 and Level-2 Products.

System Description

The complete IPOPP includes the Front End System (FES), the Data System (DS), and the Science Processing Algorithms (SPAs). See Figure 1. Additional information on IPOPP and its components is available at: http://directreadout.sci.gsfc.nasa.gov/index.cfm?section=technology&page=IPOPP

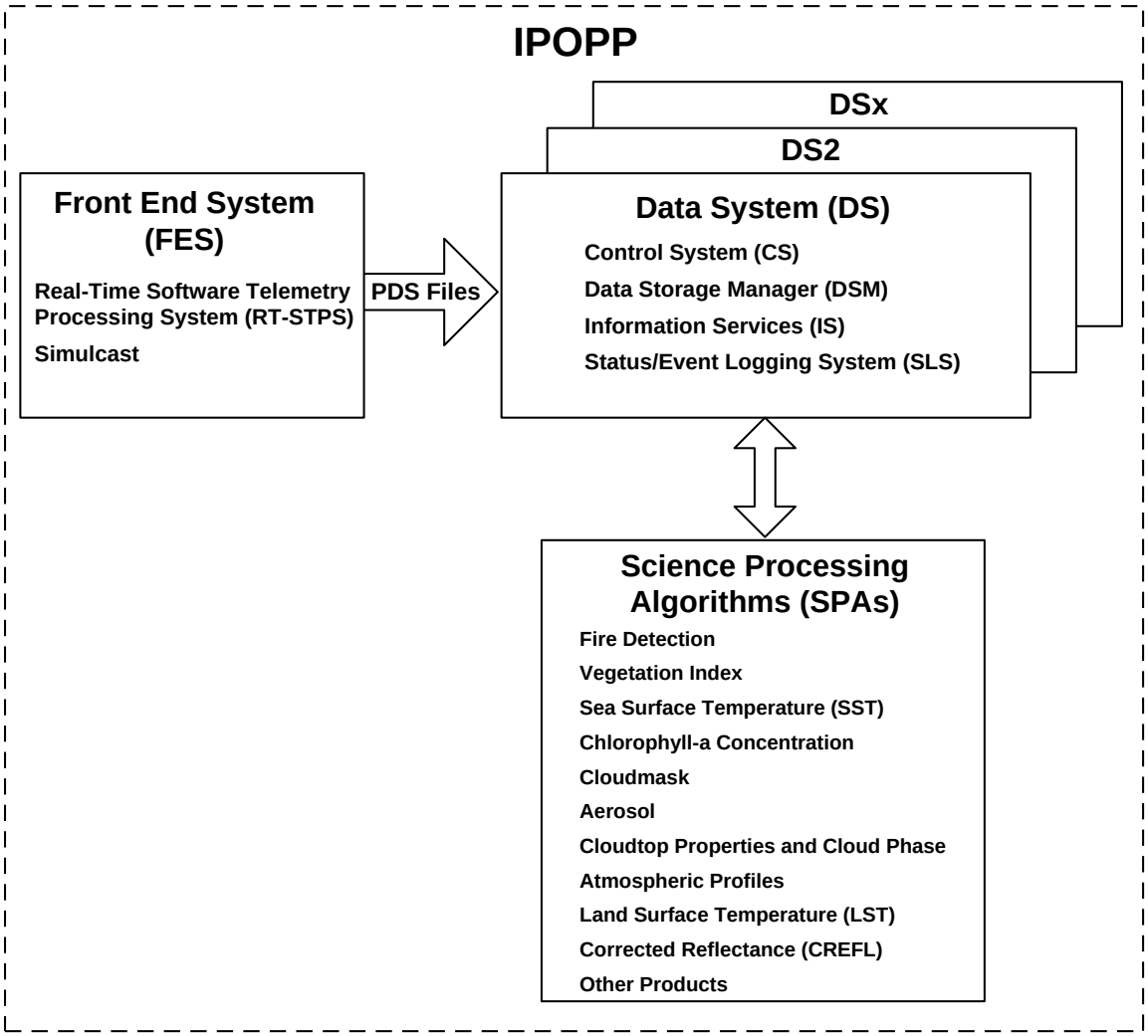


Figure 1. Major IPOPP Components

The FES contains the software and hardware to convert unsynchronized downlink data telemetry to Level-0 Production Data Set (PDS) (packet file and Construction Record [CSR]) file pairs. The FES is not part of this distribution.

The DS contains the Control System (CS), the Data Storage Manager (DSM), the Information Services (IS), and the Status/Event Logging System (SLS). The CS assembles the requisite input resources and schedules the execution of the SPAs. SPAs generate the Level-1 and Level-2 end products. A separate instance of the CS controls each algorithm. Appendix B, "SPA Execution List," lists the included SPAs. The functions of these SPAs are described in Appendix E, "Description of Science Processing Algorithms."

The DSM maintains a MySQL Database describing the location of data files and products, as well as metadata for the products. DSM agents move data among the various IPOPP components and store all products in the IS Data Repository.

The IS maintains a static subdirectory tree, the IS Data Repository, where products and data files are stored. The IS retrieves ancillary data files from the DRL or other remote locations and places them in this subdirectory. See Appendix F, "Information Services Repository Overview," for additional information.

The SLS manages and displays messages logged by the IPOPP components. Operation of the SLS Console is described in Appendix D, "Status/Event Logging System."

Data flow among the IPOPP components is shown in Figure 2. The FES (the User's front end equivalent) places packet and CSR file pairs in a specified location where the DSM PdsMover agent discovers and copies them to the IS Repository while registering the files with the DSM.

Using File Transfer Protocol (FTP), the IS retrieves ancillary data files from the DRL's IS Data Repository (ftp://is.sci.gsfc.nasa.gov), stores these files at specified locations in the local IS Data Repository, and registers them with the DSM.

The CS controls SPAs and each instance is called a station. An SPA can be controlled by multiple stations and each such station can produce one or more products. A CS station requests the requisite input resources (products and ancillaries) from the DSM and waits for the DSM Retriever agent to make the input resources available prior to SPA execution. The SPA output products are registered with the DSM.

The DSM Publisher agent copies registered products to the IS Data Repository, where they are available for subsequent retrieval by the DSM Retriever agent for inputs to successor SPAs.

The DSM API can be used by future applications to access IPOPP products and metadata.

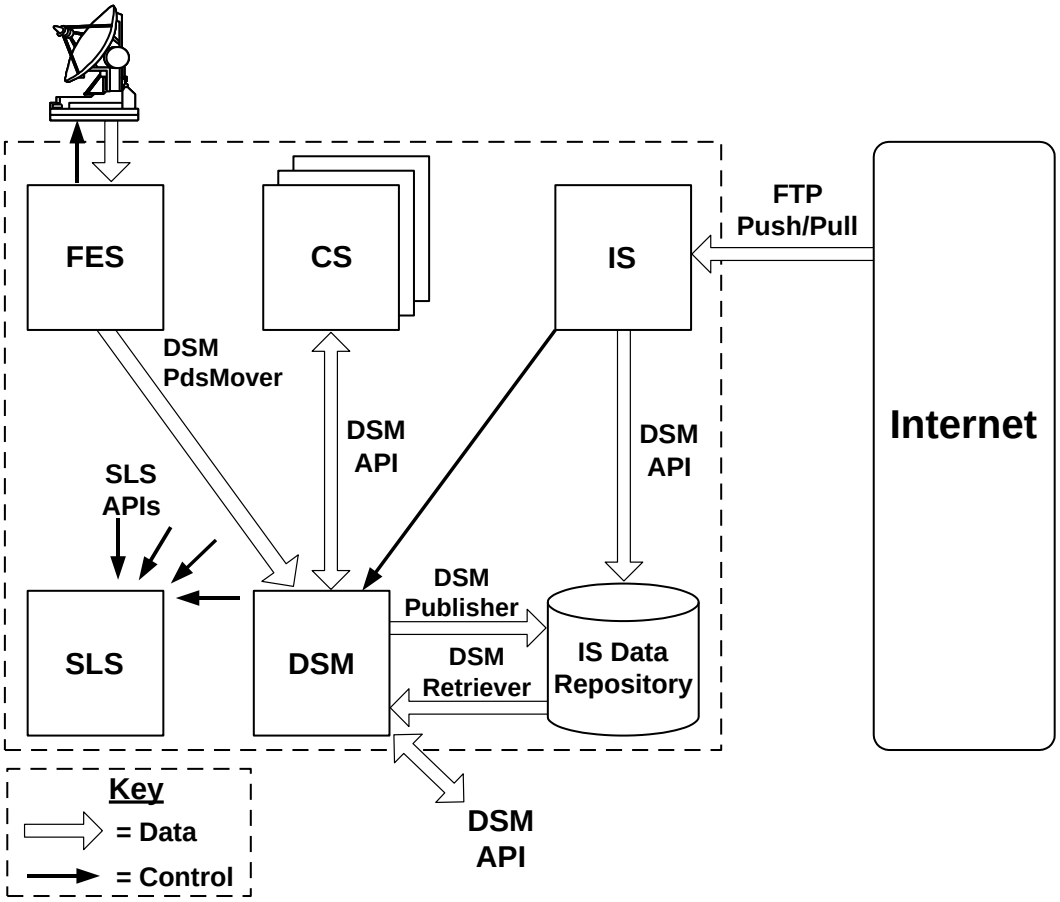


Figure 2. IPOPP Data Flow

Downloading the IPOPP Software Package

The IPOPP Software Package is publicly available from the DRL Web Portal as a compressed archive (tar) file. To accommodate users with limited Internet bandwidth, the compressed tar file is downloaded in several segments which are subsequently reassembled on the local computer.

The file segments must first be downloaded to the user's local computer and then reassembled and validated. To retrieve the file:

a) Provide a convenient empty local subdirectory to contain the software package, and

b) Go to: http://directreadout.sci.gsfc.nasa.gov/ and select "+DOWNLOADS" from the top menu, and

c) Select "DRL Software/Algorithms List" to display a table of the currently released software,

d) From the displayed table, select "IPOPP",

e) If prompted with a login box, enter your e-mail address and password as registered with the DRL. If you are a new user, first select "Register Now" to create an account. Click on "+SIGN IN" to display the IPOPP Software Description Page,

f) Click on the "Download" button on the Software Description page to select the Software Usage Agreement.

g) Read and accept or reject the presented software agreement. Questions or concerns should be directed as noted in the "General" section of this IPOPP User's Guide,

h) Click on the "I Agree" button to select the Download Page, which will display the IPOPP file segments, the md5_checksum.txt, and the reassemble.sh script.

i) Successively download each of the file segments to the empty local subdirectory by selecting the displayed hyperlinks. The segments will be of the form:

```
DRL-IPOPP_1.7a-seg00
DRL-IPOPP_1.7a-seg01
...
DRL-IPOPP_1.7a-segNN
```

j) Download the "md5_checksum.txt" and the "reassemble.sh" script to the same local subdirectory, and

k) From the local subdirectory, make the reassemble.sh script executable and run to rejoin the installation file segments and to validate the reconstructed DRL-IPOPP_1.7a.tar.gz file. Execution may take several minutes. The script should return "DRL-IPOPP_1.7a.tar.gz: OK":

```
chmod +x reassemble.sh
./reassemble.sh
```

l) Untar the DRL-IPOPP_1.7a.tgz file into the home directory of the IPOPP user (the account that is going to actually run IPOPP). Execution may take several minutes. From the local subdirectory:

```
tar -C $HOME -xzf DRL-IPOPP_1.7a.tar.gz
```

m) Optionally delete the local subdirectory containing the downloaded segments and DRL-IPOPP_1.7a.tar.gz file.

IPOPP Installation

The installation scripts provide Real-time Processing Mode or Archive Reprocessing Mode configuration options.

a) The Real-time Processing Mode option installs the IPOPP on a single computer. Installation instructions are contained in the "Real-time Installation" section.

b) The Archive Reprocessing Mode option installs the IPOPP on a single computer dedicated to reprocessing archived products. Installation instructions are contained in the "IPOPP Archive Reprocessing" section.

User Privilege Requirements

The first part of the following IPOPP installation instructions requires root privilege. The remainder of each installation option should be completed as a user with standard privileges who will operate the IPOPP. These instructions assume the environmental variable $HOME = /home/*userdirectory*, e.g., /home/ipopp.

Re-installation of IPOPP

If the IPOPP is being updated from a previous installation:

a) Stop the IPOPP Services (see the "IPOPP Operation" section). Failure to halt the IPOPP Services prior to a new installation may leave rogue services running, and result in anomalous behavior.

```
$HOME/drl/tools/services.sh stop
```

b) Clear products and dynamic ancillary files from the MySQL database:

```
chmod +x  $HOME/drl/dsm/bin/erase_database.sh
$HOME/drl/dsm/bin/erase_database.sh
```

c) Remove all files created by the previous installation process, including the $HOME/drl/ and /raid/* subdirectories:

```
/bin/rm -rf $HOME/drl
/bin/rm -rf /raid/*
```

Real-time Installation

These instructions install the IPOPP on a single computer.

A system administrator with root privilege should complete instructions 1 through 5. The IPOPP software user should complete the remaining steps.

1. Verify that the target computer meets the system requirements in Appendix A, "System Requirements," before installing this IPOPP software package.

2. Log in as root.

3. MySQL must be installed and configured to execute when the operating system boots. MySQL must be executing with the root password set to "b28c935". To initially set the root password, enter:

   mysqladmin -u root password b28c935

   To change an existing root password, enter:

   mysqladmin -u root password -p <*old_password*> b28c935

   The IPOPP software requires that the MySQL default character set be latin1. On some versions of MySQL the default character set must be changed from utf8 to latin1. This occurs on SUSE Linux 11.2 and may occur on other distributions, depending on the source of the MySQL software. To change the MySQL default character set, edit /etc/my.cnf and add the following line to the MySQL server section:

   default-character-set = latin1

   and then restart the MySQL server.

4. Create the user account with standard privileges where the software will be installed and executed. This user will operate the IPOPP.

5. Create the /raid directory. The IPOPP user must own and have read/write access to the /raid subdirectory.

The IPOPP user should complete instructions 6 through 11.

6. Log in as the IPOPP user. The following instructions assume that $HOME is the user account subdirectory, and that this is the current subdirectory.

7. Verify that the IPOPP subdirectory resides in the $HOME directory. The name and location of this directory is important. The directory/filename path must be $HOME/IPOPP for the software to install.

8. Change the $HOME/IPOPP directory and contents permissions to owner rwx, group rx and other rx:

   chmod -R 755 $HOME/IPOPP

9. Verify that the computer system has the requisite software components installed (as listed in Appendix A, "System Requirements"):

   a) Make the $HOME/IPOPP the current directory:

      cd $HOME/IPOPP

   b) Run the script: ./system_test.sh. The System Administrator should correct any deficiencies noted by the script.

10. Install the IPOPP software. From the $HOME/IPOPP subdirectory:

    a) Make the $HOME/IPOPP the current directory:

       cd $HOME/IPOPP

    b) Run the script: . /install_realtime.sh. Correct any deficiencies noted by the script. The script will install the software in a $HOME/drl subdirectory and exit. The installation will take several minutes. Error messages should be reported to the DRL. When installation begins, the script will output the following:

```
**********************************************
   IPOPP 1.7a SOFTWARE INSTALLATION UTILITY
**********************************************

Configuring IPOPP for Real-time Processing
Mode...
```

    c) When installation is complete, the script will output the following:

```
Real-time Processing Mode installation complete.
```

11. Start the IPOPP Services as described under "Initial IPOPP Start" in the "IPOPP Operation" section.

IPOPP Operation

The following instructions for starting, halting and determining the status of the IPOPP should be executed from the $HOME/drl subdirectory. The IPOPP host must have Internet access.

Initial IPOPP Start

The IPOPP should run for about 30 minutes before starting product generation (see step 3) to allow initial retrieval of ancillary files and to reduce the number of transient errors displayed by the SLS Console.

1. Optionally, start the SLS Console to view the IPOPP status and event messages. Enter:

   $HOME/drl/nsls/bin/nsls-console.sh &

   and choose "localhost:3500" from the "SLS Server Selection" pulldown menu. Click "select".

   The SLS Console will initially be unable to connect to the SLS Server until the remaining services are started in step 2; the "connection refused" message is normal.

2. Start the IPOPP Services. Enter:

   $HOME/drl/tools/services.sh start

   If an SLS Console is running, it should connect to the SLS Server at this point. Set the SLS Console to LIVE Mode after it connects to the SLS Server. See Appendix D, "Status/Event Logging System."

3. Wait about 30 minutes for the ancillary retrievers to retrieve an initial set of ancillary files.

   NOTE: "Network Unreachable" or other transient error messages may be written to the SLS Console until the IPOPP Services completely initialize.

4. To start product generation, transfer packet and CSR file pairs to /raid/dsm/nisfes_data on the IPOPP host. See Appendix C, "Receiver Interface to IPOPP." After two minutes, the IPOPP will move the files to, and begin storing products in, the IS Repository. See Appendix F, "Information Services (IS) Repository Overview."

IPOPP Stop

Halt the IPOPP Services by entering:

$HOME/drl/tools/services.sh stop

IPOPP Reset

If the MySQL database has been damaged, then stop the IPOPP Services and clear product registration from the database:

1. Stop the IPOPP Services:

   $HOME/drl/tools/services.sh stop

2. Clear product registration from the database:

   $HOME/drl/dsm/bin/erase_database.sh

3. Start the IPOPP Services:

   $HOME/drl/tools/services.sh start

IPOPP Status

To determine the status of the IPOPP Services and SPAs, enter the following command. It lists any IPOPP Services or SPAs unexpectedly halted:

$HOME/drl/tools/system_status.sh

If all IPOPP Services and SPAs are running normally, there will be no output.

Halting the IPOPP Services or SPAs by other than the specified procedures can cause "rogue" IPOPP processes to escape the normal process controls, resulting in anomalous and difficult-to-diagnose IPOPP behavior. The following script identifies apparent IPOPP Services not under proper services controls:

$HOME/drl/tools/check_services.sh

The script will print "Everything looks OK" to the SLS Console if no errors are detected, otherwise it will print a list of processes that may not be under process control.

To stop all IPOPP Services and the processes detected by check_services.sh, run the script:

$HOME/drl/tools/kill_services.sh

IPOPP Data Input

Appendix C, "Receiver Interface to IPOPP," includes instruction for testing the IPOPP by inputting packet and CSR file pairs. The SLS Server and Console should be started first, in LIVE Mode, to display any error messages (see Appendix D). Example lists of output products may be found in Appendix I, "IPOPP Products".

Diagnosing IPOPP Operational Errors

This section outlines procedures and resources for identifying problems resulting in the failure of the IPOPP to generate products. It is assumed here that the IPOPP is installed correctly, and that problems are not a consequence of hardware failure. The objective is to detect failures by observing the SLS Console or the absence of products or ancillary data, and by examining the relevant logs or diagnostic outputs. Figure 3, "DS Data Paths and Diagnostic Sources," shows the general data flow through the DS and lists the relevant logs or diagnostic sources in italics.

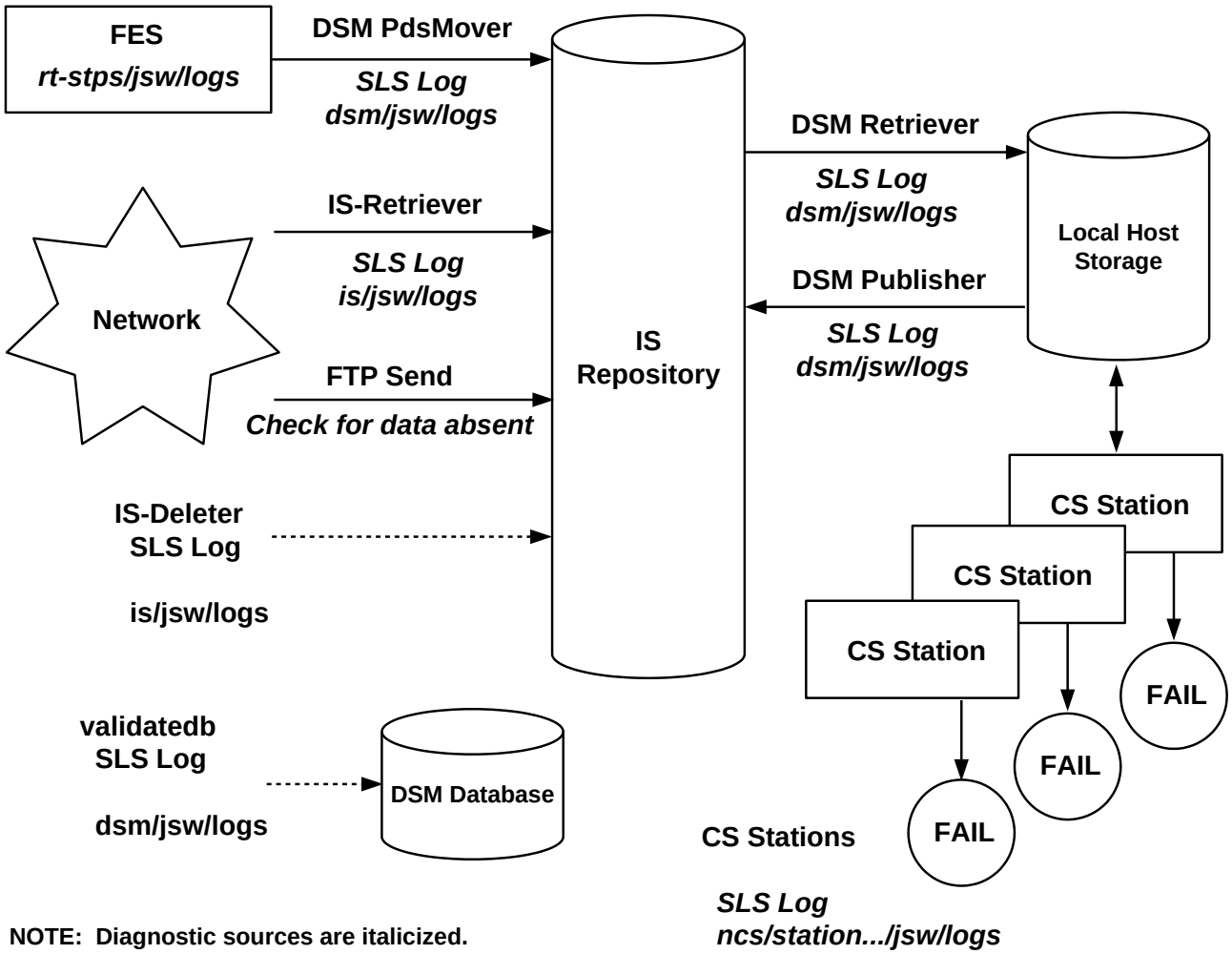


Figure 3. DS Data Paths and Diagnostic Sources

Status/Event Logging System
IPOPP Services report events to the Status/Event Logging System (SLS), where they can be viewed with the SLS Console. (See Appendix D, "Status/Event Logging System.") Most events displayed originate from normal system operation. Warning events are displayed with a yellow background, and errors are displayed with a red background. Most warning and error events have system backtrace information, which can be viewed by selecting the button to the left of the event.

Java Service Wrapper Log Files
The Java Service Wrapper (JSW) framework controls IPOPP Services. The IPOPP Services are started or stopped, and their status displayed, through commands to the JSWs. The DSM, IS, and SLS Services subdirectories have jsw subdirectories containing their JSW configuration information. Each CS station controlling an SPA also has a JSW subdirectory.

If a service does not start, or if it stops immediately after being started, the log in the appropriate jsw/logs directory should be checked. See Figure 3.

Information Services (IS) Log Files
Ancillary data are sent by FTP to the IS Repository from remote sites, or acquired from remote sites by the IS-Retriever using HTTP or FTP protocols. Files are periodically removed from the IS Repository by the IS-Deleter.

Ancillary data sent by FTP are not registered with the DSM and do not generate SLS messages. Failures to acquire these data are directly detected by their absence. These failures may be caused by problems at the remote site or network disruption, and are resolved through communication with contacts at the remote site.

The IS-Retriever may fail to acquire ancillary data from a remote site without logging an SLS error message because the retriever is not running or because a process was halted. These failures are detected directly by noting absence of the expected data, or indirectly by warning/error messages from a CS station that requests the data. In either case, the SLS Console should be started and set to LIVE Mode, and the IS-Retriever restarted. The SLS Console should be checked to verify that the missing ancillary data are retrieved. To restart the IS-Retriever, enter:

```
$HOME/drl/is/jsw/bin/is-retriever.sh stop
$HOME/drl/is/jsw/bin/is-retriever.sh start
```

The IS-Retriever logs SLS error messages if there is a network disruption, the requested file is not on the remote site, or the file cannot be stored in the IS Repository subdirectory.

The IS-Retriever and the IS-Deleter also write SLS messages to local logs. These logs may be helpful where the SLS Console is unavailable:

is/logs/retriever-nsls.log, and
is/logs/deleter-nsls.log.

The IS-Retriever and IS-Deleter JSWs also write logs useful for determining the cause of program startup or execution failure:

is/jsw/logs/is-retriever.log, and
is/jsw/logs/is-deleter.log.

Control System (CS) Log Files

The CS controls product generation. The CS assembles the requisite input resources and schedules the execution of Science Processing Algorithms (SPAs). SPAs generate the Level-1 and Level-2 end products from Level-0 products. A separate instance of the CS controls each algorithm and is called a station. These CS stations are located in the subdirectory ncs/stations.

Each CS station logs error messages to the SLS if the DSM fails to retrieve a requisite SPA input ancillary file or product, the SPA reports an error, or SPA execution fails because of an internal error. SLS messages are also optionally written to a file, by convention station.stationlog, in the station directory $HOME/drl/ncs/stations/<station name>.

Each station run is performed in a RUN directory in the corresponding station subdirectory. The RUN directory is by default deleted after a successful run. If an error occurs, the CS will rename the RUN subdirectory in the CS station to FAIL and retain this subdirectory. This FAIL subdirectory generally contains temporary files, program standard and error outputs used by the SPA, and can be useful for determining the cause of a failure.

The CS station JSWs also write to a log file in each station subdirectory: jsw/logs. These logs may be useful in resolving issues where the station does not start or fails without writing SLS messages.

NOTE: Noisy or short spacecraft passes often result in failure of the MODISL1DB_SPA. Generally, these errors can be ignored. Errors not attributable to bad or missing data should be reported to the DRL.

Data Storage Manager (DSM) Log Files

The DSM maintains a MySQL Database describing the location of data files and products. DSM agents move data among the various IPOPP components and store all products in the IS Data Repository. These agents log messages to the SLS and also write to log files in the dsm/jsw/logs.

The DSM PdsMover agent moves packet and CSR file pairs from the FES to the IS Repository.

The Capsule agent generates metadata for all product files in the IS Repository.

The validatedb agent periodically traverses the DSM database and deletes invalid references.

The MySQL Database maintains product and ancillary data locations and other information required by the DSM. Should the database be damaged, it can be repaired as follows:

1. Stop the IPOPP (see "IPOPP Stop" in the "IPOPP Operation" section),
2. Run the command:

   $HOME/drl/dsm/bin/rebuild_database.sh
3. Reset the IPOPP (See "IPOPP Reset" in the "IPOPP Operation" section).

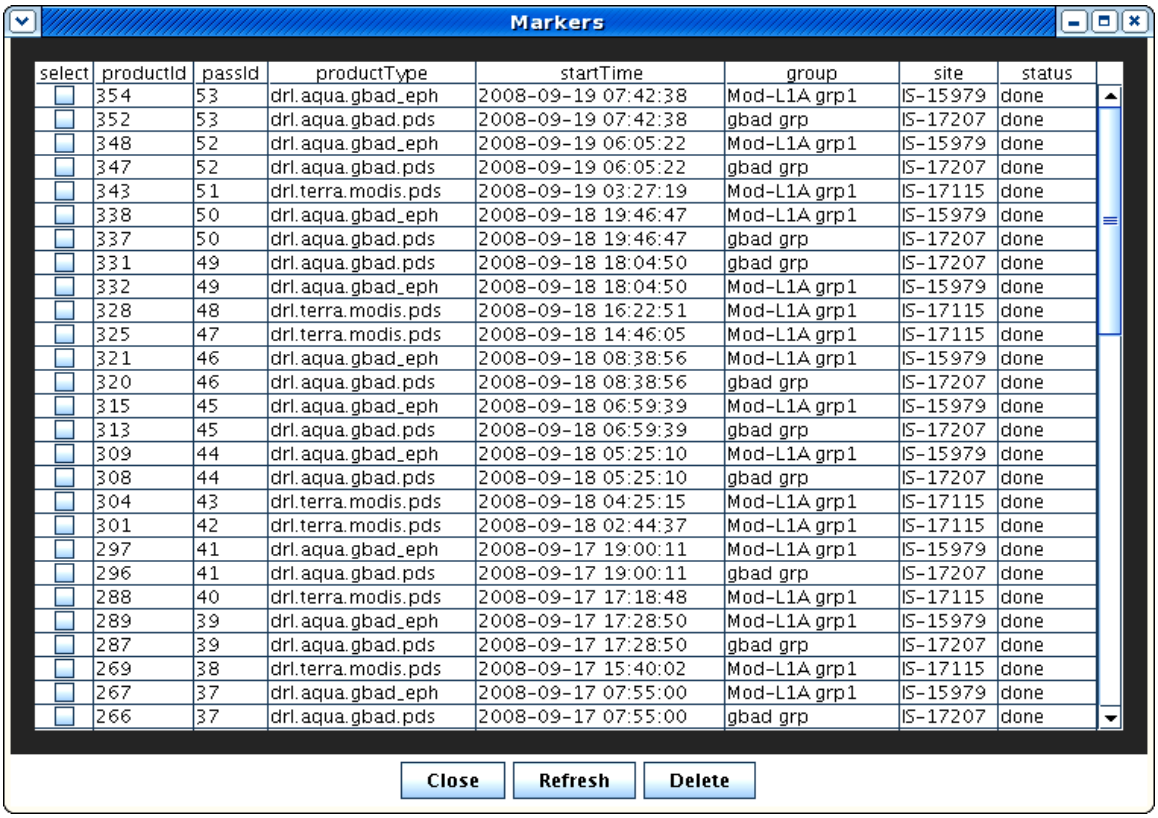
Reprocessing After an Error

Generally, errors occurring while running an SPA will cause the CS station to abandon execution of the SPA for that pass, and the system will not automatically rerun the SPA on those data.

Failed SPA executions may be manually restarted using the Markers Table. The Markers Table can be launched from the command line:

$HOME/drl/dsm/gui-scripts/markers.sh

causing the Markers Table window to appear, as depicted in Figure 4.



select	productId	passId	productType	startTime	group	site	status
☐	354	53	drl.aqua.gbad_eph	2008-09-19 07:42:38	Mod-L1A grp1	IS-15979	done
☐	352	53	drl.aqua.gbad.pds	2008-09-19 07:42:38	gbad grp	IS-17207	done
☐	348	52	drl.aqua.gbad_eph	2008-09-19 06:05:22	Mod-L1A grp1	IS-15979	done
☐	347	52	drl.aqua.gbad.pds	2008-09-19 06:05:22	gbad grp	IS-17207	done
☐	343	51	drl.terra.modis.pds	2008-09-19 03:27:19	Mod-L1A grp1	IS-17115	done
☐	338	50	drl.aqua.gbad_eph	2008-09-18 19:46:47	Mod-L1A grp1	IS-15979	done
☐	337	50	drl.aqua.gbad.pds	2008-09-18 19:46:47	gbad grp	IS-17207	done
☐	331	49	drl.aqua.gbad.pds	2008-09-18 18:04:50	gbad grp	IS-17207	done
☐	332	49	drl.aqua.gbad_eph	2008-09-18 18:04:50	Mod-L1A grp1	IS-15979	done
☐	328	48	drl.terra.modis.pds	2008-09-18 16:22:51	Mod-L1A grp1	IS-17115	done
☐	325	47	drl.terra.modis.pds	2008-09-18 14:46:05	Mod-L1A grp1	IS-17115	done
☐	321	46	drl.aqua.gbad_eph	2008-09-18 08:38:56	Mod-L1A grp1	IS-15979	done
☐	320	46	drl.aqua.gbad.pds	2008-09-18 08:38:56	gbad grp	IS-17207	done
☐	315	45	drl.aqua.gbad_eph	2008-09-18 06:59:39	Mod-L1A grp1	IS-15979	done
☐	313	45	drl.aqua.gbad.pds	2008-09-18 06:59:39	gbad grp	IS-17207	done
☐	309	44	drl.aqua.gbad_eph	2008-09-18 05:25:10	Mod-L1A grp1	IS-15979	done
☐	308	44	drl.aqua.gbad.pds	2008-09-18 05:25:10	gbad grp	IS-17207	done
☐	304	43	drl.terra.modis.pds	2008-09-18 04:25:15	Mod-L1A grp1	IS-17115	done
☐	301	42	drl.terra.modis.pds	2008-09-18 02:44:37	Mod-L1A grp1	IS-17115	done
☐	297	41	drl.aqua.gbad_eph	2008-09-17 19:00:11	Mod-L1A grp1	IS-15979	done
☐	296	41	drl.aqua.gbad.pds	2008-09-17 19:00:11	gbad grp	IS-17207	done
☐	288	40	drl.terra.modis.pds	2008-09-17 17:18:48	Mod-L1A grp1	IS-17115	done
☐	289	39	drl.aqua.gbad_eph	2008-09-17 17:28:50	Mod-L1A grp1	IS-15979	done
☐	287	39	drl.aqua.gbad.pds	2008-09-17 17:28:50	gbad grp	IS-17207	done
☐	269	38	drl.terra.modis.pds	2008-09-17 15:40:02	Mod-L1A grp1	IS-17115	done
☐	267	37	drl.aqua.gbad_eph	2008-09-17 07:55:00	Mod-L1A grp1	IS-15979	done
☐	266	37	drl.aqua.gbad.pds	2008-09-17 07:55:00	gbad grp	IS-17207	done

Figure 4. Markers Table

Each line in the Markers Table displays an attempted SPA execution. Failed SPA executions are indicated by the word "FAILED" in the "Status" column.

An SPA execution can be restarted by checking the corresponding select box and pushing the Delete Button. If the SLS is in LIVE Mode, new CS log messages should appear after a few seconds. The Refresh button updates the entire display to the current DSM status. Figure 5 contains the steps necessary to process data after an error.

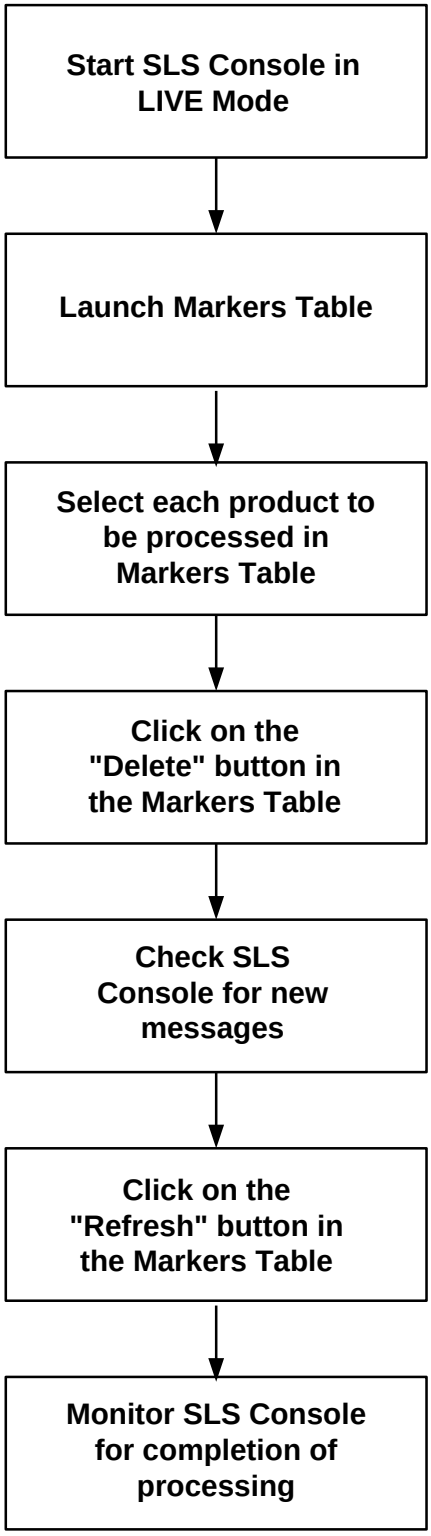


Figure 5. Reprocessing After an Error

Installing New SPAs

The IPOPP installed by this package includes the SPAs currently distributed by the DRL, with the exception of MOD09_SPA. Newly released SPAs are publicly available on the DRL Web Portal.

Instructions for installing new SPAs in an existing IPOPP:

1. Download the new SPA from the DRL Web Portal to the $HOME/drl/ subdirectory.
    a. Go to: http://directreadout.sci.gsfc.nasa.gov/ and select "+DOWNLOADS" from the top menu, and
    b. Select "DRL Software/Algorithms List" to display a table of the currently released SPAs.
    c. From the displayed table, select the SPA to be installed on the local IPOPP.
    d. If prompted with a login box, enter your e-mail address and password as registered with the DRL. If you are a new user, first select "Register Now" to create an account. Push "+SIGN IN" to display the IPOPP Software Description Page.
    e. Push the "Download" button on the Software Description page to select the Software Usage Agreement.
    f. Read and accept or reject the presented software agreement. Questions or concerns should be directed as noted in the "General" section of this IPOPP User's Guide,
    g. Push the "I Agree" button to select the Download Page, which will display the SPA Description page.
    h. Select the compressed archive (tarball) files to download. The file name will be of the form:

    *algorithm_algorithm versionno*_SPA_*wrapper versionno*.tar.gz

    (for example, L2GEN_6.2.5_SPA_1.1.tar.gz).

2. Remove any existing SPAs to be updated. New SPAs may be safely installed while the IPOPP is executing. If the new SPAs were not previously installed, this step should be bypassed. However, existing SPAs can only be safely updated when the current version has stopped generating products and has been removed.

    a. Product generation can be halted by stopping file transfers from the FES and waiting for the currently executing SPAs to complete.

        To stop file transfers from the FES, halt the PdsMover by entering the following command:

        $HOME/drl/dsm/jsw/bin/pdsmover.sh stop

    b. When the IPOPP completes product generation and is quiescent, halt the IPOPP SPA Services by entering:

        $ HOME/drl/tools/spa_services.sh stop

    c. Delete the existing SPA from the SPA subdirectory:

        rm -r $ HOME/drl/SPA/*spa_subdirectory_name*

3. Install the new or updated SPAs. The following procedures require the IPOPP MySQL Server to be running.

    a. Decompress and extract the contents from the archive. From the $HOME/drl subdirectory:

        tar -xzf *algorithm_algorithm versionno*_SPA_*wrapper versionno*.tar.gz.

        This will create a new *algorithm* subdirectory in the $HOME/drl/SPA directory.

    b. Create CS Stations in the $HOME/drl/ncs/stations subdirectory. From the $HOME/drl subdirectory, execute the install script in the new SPA subdirectory:

        ./$HOME/drl/SPA/*spa_subdirectory_name*/NISGSinstall.sh

    c. Enable the CS Stations. Edit the:

        $HOME/drl/ncs/configs/default_config.file

        and add the CS Station name. See Appendix B, "Science Processing Algorithm Execution List," for details.

4. Start the SPAs. From the $HOME/drl subdirectory, enter:

   $HOME/drl/tools/spa_services.sh start.

   This command starts all CS stations in the drl/ncs/configs/default_config.file not currently running.

5. Restart the PdsMover. If the PdsMover was halted in Step 2, restart it:

   $HOME/drl/dsm/jsw/bin/pdsmover.sh start

IPOPP Archive Reprocessing

This section provides instruction for reprocessing previously acquired Aqua and Terra spacecraft MODIS Level-0 data using IPOPP software and archived ancillary files. For this release, Archive Reprocessing has been extensively tested for Terra data, less so for Aqua data. A later development phase of this product, based on responses from the user community, will provide a more general reprocessing framework.

The Construction Record Builder (CRECBuilder) Program may be useful where the required Construction Records (CSRs) corresponding to the Level-0 packet files are otherwise unavailable.

Further information on IPOPP and its components and CRECBuilder is available at:

http://directreadout.sci.gsfc.nasa.gov/index.cfm?section=technology&page=IPOPP

Archive Reprocessing Overview

The normal IPOPP processing system maintains a sliding window of real-time data, typically the most recent 14 days. Data that ages past the sliding window interval are removed from the system by the IS-Deleter. Archive Reprocessing brings this expired data back into the system for reprocessing. Archive Reprocessing is described in this section and requires slightly different processing procedures than those for Reprocessing After an Error, in order to re-ingest the prerequisite ancillary files necessary for processing.

Products are reprocessed on a dedicated computer where IPOPP is installed in Archive Reprocessing Mode. Ancillary files spanning the period of interest are copied from the compressed ancillary archive on the remote DRL IS Repository to a local subdirectory accessible to the Archive Reprocessing IPOPP. The Archive Reprocessing IPOPP then registers these files using the Information Services (IS) configuration files provided in the reprocessing module included in this IPOPP distribution. Presently ancillary files dating back to May 2003 are available for Archive Reprocessing from the remote DRL IS Repository.

Those SPAs necessary to generate the requisite products must be installed on the Archive Reprocessing IPOPP and a configuration file must be edited to selectively enable the SPAs, as described in the "Installing New SPAs" section.

The Archive Reprocessing IPOPP is enabled by starting the IPOPP Services, and product generation is started by placing Level-0 Production Data Set (PDS) (packet file and Construction Record [CSR]) file pairs in a subdirectory scanned by IPOPP.

The Archive Reprocessing IPOPP can be halted and reinitialized with different SPAs or ancillary files and then restarted. IPOPP data flow in Archive Reprocessing mode is depicted in Figure 6. Figure 7 contains a comparison of Real-time Processing data flow vs. Archive Reprocessing data flow. Figure 8 contains the Archive Reprocessing inputs and outputs.

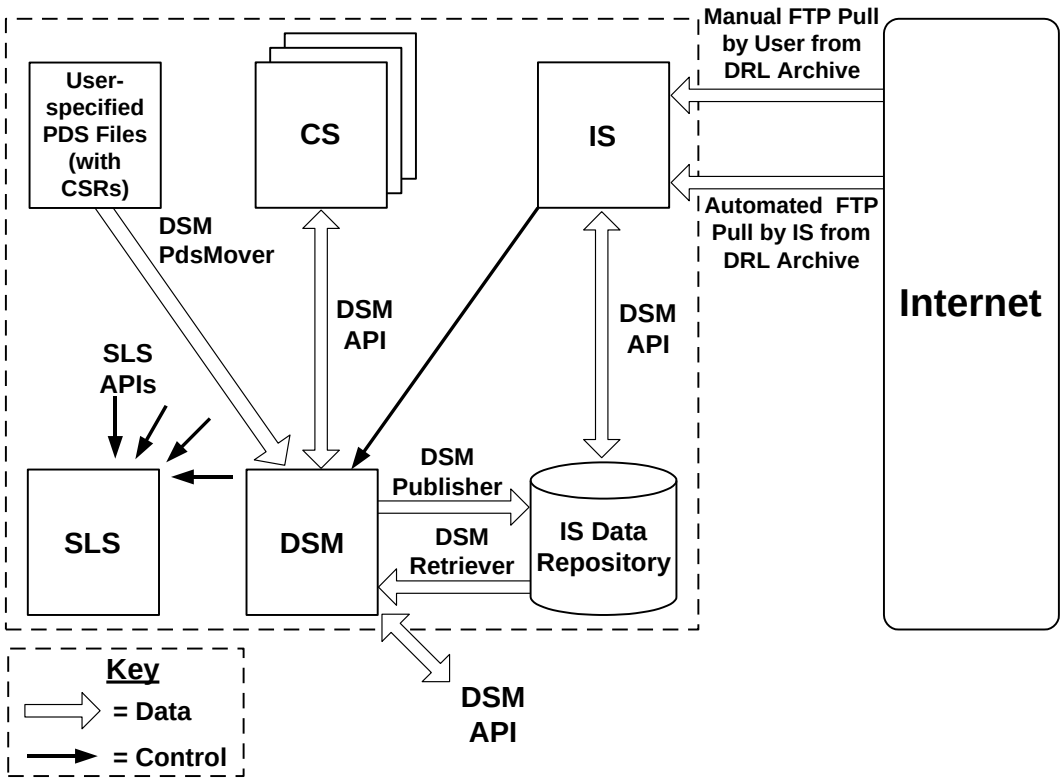


Figure 6. IPOPP Data Flow in Archive Reprocessing Mode

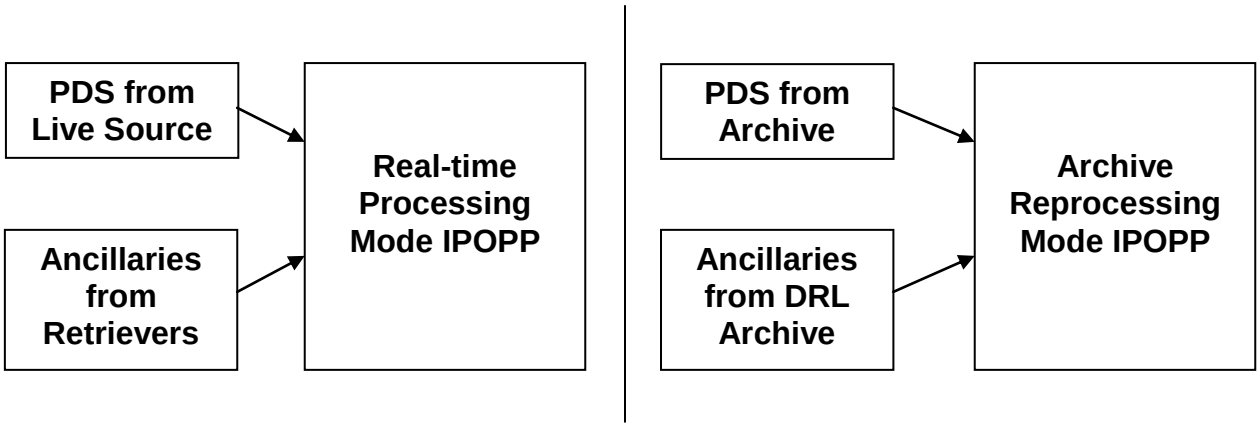


Figure 7. Real-time Processing vs. Archive Reprocessing Data Flow

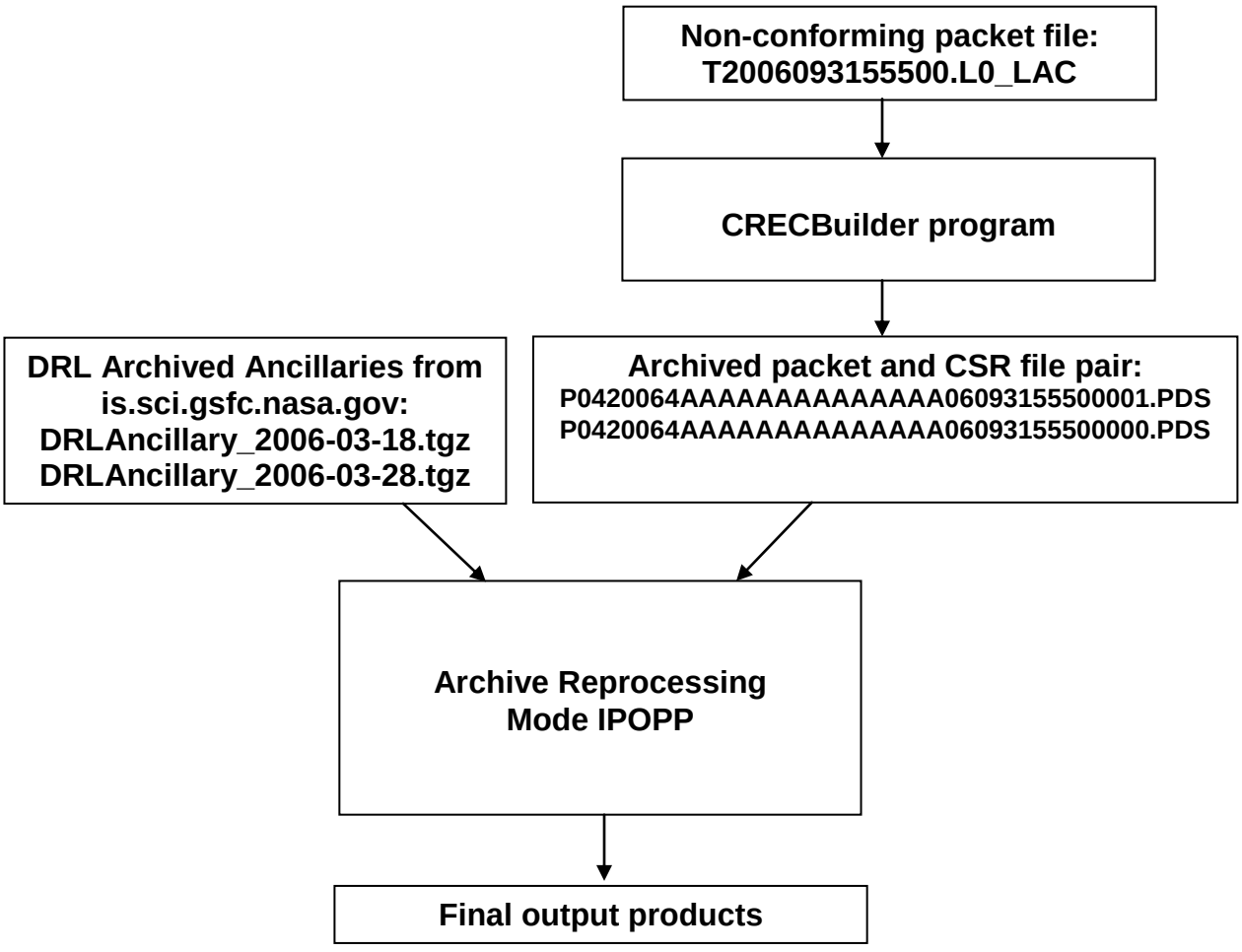


Figure 8. Archive Reprocessing Inputs/Outputs

Archive Reprocessing IPOPP Installation

NOTE: The Archive Reprocessing IPOPP must be installed on a dedicated computer, separate from IPOPP installations used for real-time processing.

A system administrator with root privilege should complete instructions 1 through 5. The IPOPP software user should complete the remaining steps.

1. Verify that the target computer meets the system requirements in Appendix A, "System Requirements," before installing this IPOPP software package.

2. Log in as root.

3. MySQL must be installed and configured to execute when the operating system boots. MySQL must be executing with the root password set to "b28c935". To initially set the root password, enter:

   mysqladmin -u root password b28c935

   To change an existing root password, enter:

   mysqladmin -u root password -p <*old_password*> b28c935

   The IPOPP software requires that the MySQL default character set be latin1. On some versions of MySQL the default character set must be changed from utf8 to latin1. This occurs on SuSE Linux 11.2 and may occur on other distributions, depending on the source of the MySQL software. To change the MySQL default character set, edit /etc/my.cnf and add the following line to the MySQL server section:

   default-character-set = latin1

   and then restart the MySQL server.

4. Create the user account with standard privileges where the software will be installed and executed. This user will operate the IPOPP.

5. Create the /raid directory. The IPOPP user must own and have read/write access to the /raid subdirectory.

The IPOPP user should complete instructions 6 through 10.

6. Log in as the IPOPP user. The following instructions assume that $HOME is the user account subdirectory, and that this is the current subdirectory.

7. Verify that the IPOPP subdirectory resides in the $HOME directory. The name and location of this directory is important. The directory/filename path must be $HOME/IPOPP for the software to install.

8. Change the $HOME/IPOPP directory and contents permissions to owner rwx, group rx and other rx:

   chmod -R 755 $HOME/IPOPP

9. Verify that the computer system has the requisite software components installed (as listed in Appendix A, "System Requirements"):

   a) Make the $HOME/IPOPP the current directory:

      cd $HOME/IPOPP

   b) Run the script: ./system_test.sh. The System Administrator should correct any deficiencies noted by the script.

10. Install the IPOPP software. From the $HOME/IPOPP subdirectory:

    a) Make the $HOME/IPOPP the current directory:

       cd $HOME/IPOPP

    b) Run the script: ./install_reprocessing.sh. Correct any deficiencies noted by the script. The script will install the software in a $HOME/drl subdirectory and exit. The installation will take several minutes. Error messages should be reported to the DRL. When installation begins, the script will output the following:

```
************************************************
    IPOPP 1.7A SOFTWARE INSTALLATION UTILITY
************************************************

Configuring IPOPP for Archive Reprocessing
Mode...
```

    c) When installation is complete, the script will output the following:

```
Archive Reprocessing Mode installation complete.
```

The Archive Reprocessing IPOPP is now ready to reprocess products as described in the next section, "Product Generation Procedures."

Product Generation Procedures

These procedures are required to initially reprocess products. The Archive Reprocessing IPOPP must first be installed as described in the previous section. The "Archive Reprocessing Installation Validation" section of this document serves as an example and a template for reprocessing. To repeat product generation, see the "Updating the Archive Reprocessing IPOPP" section.

Load SPAs

If necessary, install new or updated SPAs as instructed in the "Installing New SPAs" section.

Edit the $HOME/drl/ncs/configs/default_config.file configuration file as described in Appendix B to selectively enable SPAs.

Load Ancillary Archive Files

Copy the required ancillary files from the Compressed Archive on the DRL Information Services (IS) Repository using File Transfer Protocol (FTP).

Using anonymous FTP, copy the compressed ancillary data archives spanning the times of interest from the DRL:

is.sci.gsfc.nasa.gov:/CompressedArchivedAncillary/

to: /raid/pub on the local computer.

Change to the /raid/pub directory and untar the ancillary archives to /raid/pub/ on the local computer. This will create the /raid/pub/ArchivedAncillary directory and inflate the subdirectory structure:

```
cd /raid/pub
tar -C /raid/pub -xzf DRLAncillary_YYYY-MM-DD.tgz
…
```

Start the Status/Event Logging System (SLS) Server and an SLS Console to view log messages. Connect the Console to localhost in LIVE Mode as described in Appendix D:

```
$HOME/drl/nsls/jsw/bin/nsls-server.sh start
$HOME/drl/nsls/bin/nsls-console.sh &
```

Start a modified version of the IS-Retriever to register the ancillary archive files by running the script:

```
$HOME/drl/reprocessing/ingest-ancillaries.sh
```

Monitor the SLS Console for about 20 minutes. As the IS-Retriever starts, the SLS Console will display a few yellow warning messages that read "not scheduled, runflag is false". The SLS Console may also display warnings that read "No remote FTP files in dir". This is normal for some ancillary files. The registrations and retrievals are staggered to reduce the number of simultaneous socket connections; the IS-Retriever must run for the complete duration. The script will print messages as it runs each registration task, like this:

```
Turned drl.modis_aqua_csrb.xml on
Turned drl.modis_terra_csrb.xml on
Turned drl.ncep_gdas.xml on
Turned drl.ncep_met.xml on
Turned drl.noaa_oisst.xml on
Turned drl.noaa_toast.xml on
Turned drl.noaa_tovs.xml on
Turned drl.obpg.noaa_toast.xml on
Turned drl.obpg_seaice.xml on
Turned drl.ssmi_nise.xml on
Turned drl.ssmi_seaice.xml on
Ancillaries should be ready when logger is quiet
```

When the SLS Console has not displayed any messages for several minutes, stop the IS-Retriever by running:

$HOME/drl/reprocessing/stop-ingest.sh

Adding PDS Files

Place each instrument packet file, followed by its Level-0 Construction Record (CSR) file, in the /raid/dsm/nisfes_data subdirectory where it will be detected by IPOPP. Order is important: follow the procedures detailed in Appendix C, "Receiver Interface to IPOPP."

Initial IPOPP Start

Start the IPOPP as described in "Initial IPOPP Start." Enter:

$HOME/drl/tools/services.sh start

Stopping IPOPP

When reprocessing is complete, stop the IPOPP by entering:

$HOME/drl/tools/services.sh stop

Figure 9 summarizes the steps necessary for archive reprocessing.

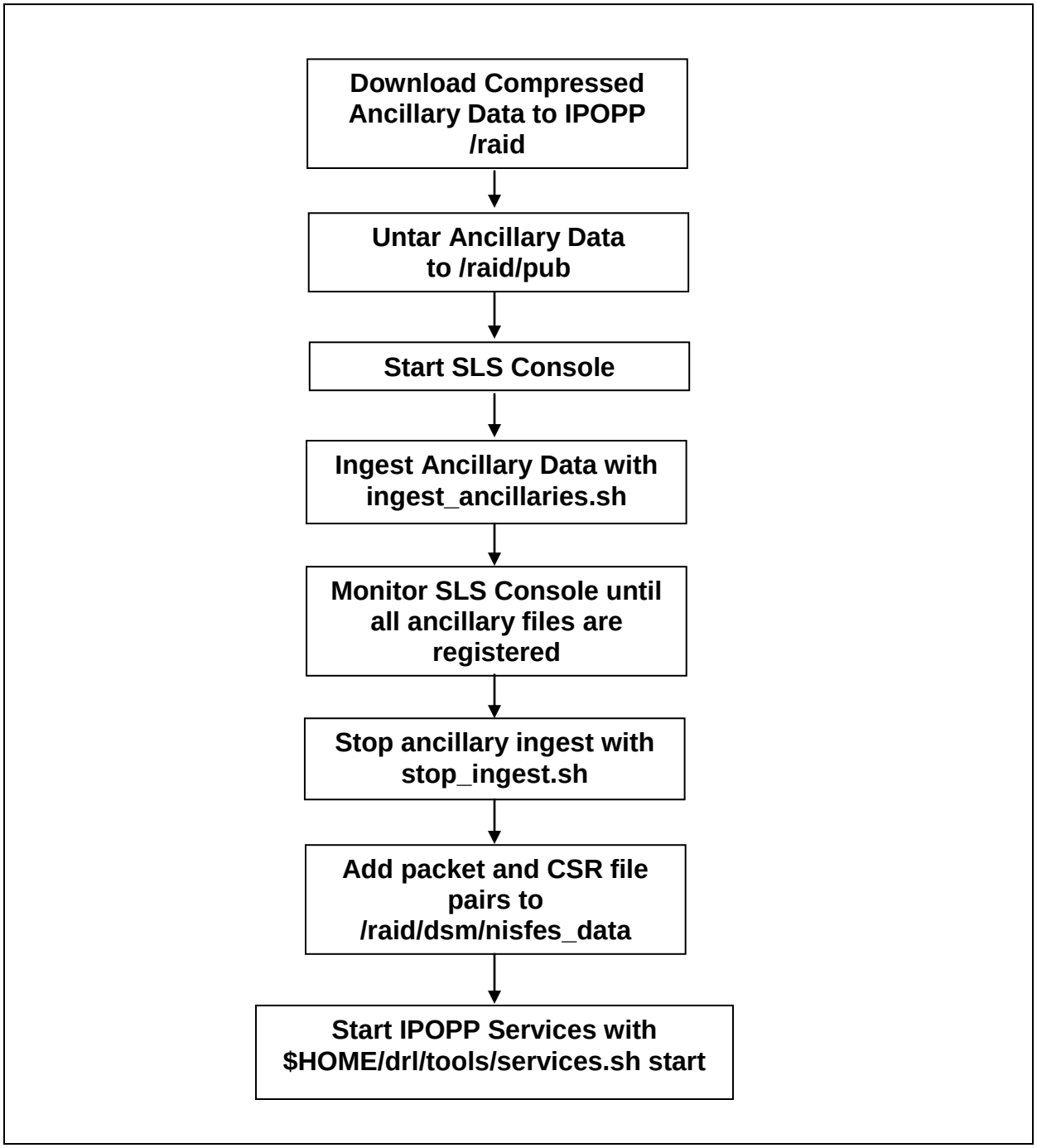


Figure 9. Summary of Archive Reprocessing Steps

Updating the Archive Reprocessing IPOPP

SPAs, ancillary files, and products may be added to the Archive Reprocessing IPOPP as described in the previous sections of this document. The Archive Reprocessing IPOPP should be stopped when updated.

Processing Additional Packet File and CSR File Pairs

Additional packet file and CSR file pairs may be processed by adding them to the /raid/dsm/nisfes_data subdirectory as described in the "Adding PDS Files" section.

Adding Ancillary Files

Additional ancillary files may be added to the Archive Reprocessing IPOPP as described in the "Load Ancillary Archive Files" section.

Clearing the Archive Reprocessing IPOPP

The Archive Reprocessing IPOPP should be cleared when existing ancillary files are to be replaced, or previously reprocessed passes are to be reprocessed again. The Archive Reprocessing IPOPP can be reset to its initial state by clearing the database and deleting the ancillary and product files as follows:

1. Stop the Archive Reprocessing IPOPP:

   ```
   $HOME/drl/tools/services.sh stop
   ```

2. Start the Status/Event Logging System (SLS) Server and an SLS Console to view log messages. Connect the Console to localhost in LIVE Mode as described in Appendix D:

   ```
   $HOME/drl/nsls/jsw/bin/nsls-server.sh start
   $HOME/drl/nsls/bin/nsls-console.sh &
   ```

3. Remove product and ancillary files by deleting them from the file system and the IPOPP database. Start the IS-Deleter using a script that changes its configuration to delete all products and ancillaries:

   ```
   $HOME/drl/reprocessing/delete-reprocessed.sh
   ```

   Watch the SLS Console. The IS-Deleter is finished when a "Delete cycle done" message appears. When the IS-Deleter stops reporting deletions to the SLS Console, run this script:

   ```
   $HOME/drl/reprocessing/stop-deleter.sh
   ```

This script stops the deleter. The script also checks to see if the database is now empty. If the script reports that the database is not empty (possibly because the file system was modified by something other than IPOPP), run this script to forcibly clear the database:

$HOME/drl/reprocessing/manual-reset.sh

Archive Reprocessing Installation Validation

This validation procedure generates products from an 03 April 2006 Terra packet file, T2006093155500.L0_LAC, included with the CRECBuilder test data available from the DRL Web Portal at:

http://directreadout.sci.gsfc.nasa.gov/index.cfm?section=downloads&page=technology

1. Install an Archive Reprocessing IPOPP on a dedicated computer as described in the "Archive Reprocessing IPOPP Installation" section.
2. Download the CRECBUILDER_1.2_testdata.tar.gz file from the CRECBuilder Download page of the DRL Web Portal to $HOME.
3. Untar the CRECBUILDER_1.2_testdata.tar.gz file to create a $HOME/CRECbuilder-testdata/ subdirectory:

   tar -xzf CRECBUILDER_1.2_testdata.tar.gz
4. In CRECBuilder-testdata/terra, rename the T2006093155500.L0_LAC packet file to conform to the PDS file naming convention. (The corresponding CSR record is already present. See the "CRECBuilder" section of this document.):

   cd $HOME/CRECBuilder-testdata/terra

   mv T2006093155500.L0_LAC \

   P0420064AAAAAAAAAAAAA06093155500001.PDS
5. Using FTP, retrieve two compressed archive files spanning the granule date from is.sci.gsfc.nasa.gov:/CompressedArchivedAncillary/:

   DRLAncillary_2006-03-18.tgz

   DRLAncillary_2006-03-28.tgz

   and store them in the /raid/ subdirectory on the local computer.
6. From the local /raid/ subdirectory, decompress and untar the archive files to the local /raid/pub/ArchivedAncillary/ subdirectory as follows:

   cd /raid

   tar -C /raid/pub -xzf DRLAncillary_2006-03-18.tgz

   tar -C /raid/pub -xzf DRLAncillary_2006-03-28.tgz

7. Start the SLS Server and Console and set the Console to localhost and LIVE Mode to monitor ancillary file registration (see Appendix D).

   $HOME/drl/nsls/jsw/bin/nsls-server.sh start

   $HOME/drl/nsls/bin/nsls-console.sh &

8. Start a modified version of the IS-Retriever to register the new ancillaries (a message warning that the server is already running is expected):

   $HOME/drl/reprocessing/ingest-ancillaries.sh

   Allow 20 minutes for registration to complete, then halt registration:

   $HOME/drl/reprocessing/stop-ingest.sh

9. Copy the packet file (renamed in step 4) and the existing CSR file in CRECBuilder-testdata/terra to /raid/dsm/nisfes_data. IPOPP will poll this subdirectory for new files. The CSR should be moved last:

   cd $HOME/CRECBuilder-testdata/terra

   cp P0420064AAAAAAAAAAAAAA06093155500001.PDS \
   /raid/dsm/nisfes_data/.

   cp P0420064AAAAAAAAAAAAAA06093155500000.PDS \
   /raid/dsm/nisfes_data/.

10. Begin product generation by starting the IPOPP Services while monitoring the SLS Console for errors. Processing should complete in about 10 minutes:

    $HOME/drl/tools/services.sh start

The Archive Reprocessing IPOPP should log no SLS errors or warnings in steps 9 and 10. The presence of the following files in /raid/pub/gsfcdata/terra/modis/level1/ is indicative of correct Archive Reprocessing IPOPP installation. Other files will be present:

```
MOD01.06093155500.hdf            535.5MB
MOD021KM.06093155500.hdf         319.7MB
MOD02HKM.06093155500.hdf         256.1MB
MOD02QKM.06093155500.hdf         266.3MB
MOD03.06093155500.hdf            056.5MB
```

CRECBuilder

Packet files and Construction Records (CSR) processed by IPOPP must conform to the Production Data Set (PDS) naming convention. The CRECBuilder Program can rename nonconforming packet files and generate CSRs from packet files where CSRs are unavailable.

By example, this CRECBuilder command:

$RUNCREC -file T2006093155500.L0_LAC \

-scid 42 -vcid 42 -apid 64 -pmin 276 -pmax 642 -createPDSFileByCopy

generates the corresponding:

P0420064AAAAAAAAAAAAAA06093155500001.PDS and

P0420064AAAAAAAAAAAAAA06093155500000.PDS

file pair required in the "Archive Reprocessing Installation Validation" section from the T2006093155500.L0_LAC original packet file.

"$RUNCREC" is a path to the CRECBuilder package. The CRECBuilder User's Guide provides a more detailed description and is available at the DRL Web Portal as part of the CRECBuilder software package, or independent of the package at:

http://directreadout.sci.gsfc.nasa.gov/index.cfm?section=links&page=documents

Appendix A
System Requirements

This software, with all SPAs enabled, has been minimally tested to the following system requirements.

Hardware

The IPOPP, with all SPAs enabled, has been tested on a computer with this configuration. Eight GB of RAM is minimally required for acceptable performance; 16GB is highly recommended. Separate physical disks for the operating system and data storage are also recommended. Performance on less capable systems may be improved by disabling unneeded SPAs. (See Appendix B, "Science Processing Algorithm Execution List.")

Processors:	Dual Quad Core AMD Opteron 2346 HE 1.8 GHZ
RAM:	8GB DDR 700MHZ minimum, 16GB recommended
Operating System Disks:	SATA 2 RAID-1 (two 500GB, 7200 r.p.m. disks)
Data Disks:	SATA 2 RAID-5 (four 500GB, 7200 r.p.m. disks) Mounted at /raid
Motherboard:	Tyan Thunder N3600m with VGA onboard

Operating Systems

The IPOPP has been tested under these operating systems. The IPOPP is expected, but not guaranteed, to run under other Linux distributions.

a) Fedora 12 X86_64;

b) CentOS Linux 5.4 X86_64;

c) Open SUSE Linux 11.2 X86_64; and

d) Kubuntu desktop 10.04 X86_64.

System Time

Some IPOPP ancillary file retrievals and product generations are time-dependent; the system should use 24-hour UTC time and be synchronized through a Network Time Protocol (NTP) Server.

Required Software
The following software must be previously installed:

a) Sun Java Development Kit (JDK) x86_64, version 1.5.0_10 or better (is missing from default installation of Fedora Linux, CentOS, and SUSE Linux, all versions). Do not use the installed free software version. The system as distributed was compiled with 1.5.0_10, and tested with 1.6.0_12 on the operating systems listed above;

b) MySQL Client and Server 5.0 or later (missing from default installation of Fedora Linux, CentOS, SUSE Linux, all versions);

c) libXp 1.0 or later (missing from default installation of Fedora Linux, CentOS, Kubuntu, and SUSE Linux);

d) bash 3.2 or later (comes with Fedora Linux, CentOS and SUSE Linux);

e) tcsh 6.1 or later (may be missing from Fedora Linux after Version 7, missing from SUSE Linux);

f) bc 1.0 or later (may be missing from default installation of Fedora Linux, CentOS, SUSE Linux, all versions);

g) ed 0.2 or later (may be missing from default installation of Fedora Linux, CentOS and SUSE Linux, all versions);

h) libxcb 1.1 for Fedora 8 and SUSE only. Upgrade Fedora 8 from libxcb 1.03 to 1.1.

i) The SPAs require 32-bit support. Linux distributions not providing native 32-bit support require the installation of ia32-libs. See Errata.

Network Firewall Configuration and Port Access
These TCP ports should be open:

a) Ports 20 and 21 for FTP;

b) Port 3306 for MySQL;

c) Ports 3500 through 3550 for SLS;

d) Ports 4900 through 4950 for DSM; and

e) Ports 49152 through 65535 for passive mode FTP.

Errata
On systems using Kubuntu, the following message may appear once the user runs the FTP setup script:

./setup_ftp.sh: line 104: chkconfig: command not found

The user should ignore this message. Kubuntu does not use the chkconfig command, and the script is merely reporting this to the user. Other Ubuntus are expected to exhibit similar behavior.

Some systems, particularly those running the Linux Kernel 2.6.22 and older with 4GB or more of memory installed, may arbitrarily halt. Where this is a problem, use conservative boot parameters. On the kernel command line set:

apm=off acpi=off mce=off

Computers with the Nvidia chipset installed on the motherboard may suddenly lose external network connectivity. This problem may be verified by searching the output of the dmesg command for numerous entries like this:

eth0: too many iterations (6) in nv_nic_irq.

To correct this problem on Fedora systems, add this line to the /etc/modprobe.conf file and reboot:

options forcedeth max_interrupt_work=128

To correct this problem on Kubuntu, add this line to the /etc/modprobe.d/options file:

options forcedeth max_interrupt_work=128, and

Add the following line to the /etc/rc.local file and reboot:

rmmod forcedeth && modprobe forcedeth && /etc/init.d/networking restart

Linux distributions not providing native 32-bit support require the installation of ia32-libs. Do not install ia32-libs on systems providing native support.

Systems known to provide native 32-bit support:

a) Redhat Enterprise,
b) Redhat Fedora,
c) SUSE,
d) CentOS.

Systems known not to provide native 32-bit support and require the installation of ia32-libs:

a) Ubuntu,
b) Kubuntu.

An IPOPP installation on Fedora Linux requires that the 32-bit version of ld-linux.so.2 is installed. This file can be obtained by installing glibc for i686.

Fedora 10 and 11 set the maximum allowed number of user processes to 1024. This number is insufficient to run IPOPP. Correct this by either:

a) (preferred) as the IPOPP user, add the following line to .bash_profile:

```
ulimit -u 65536
```

b) as root, edit the /etc/security/limits.d/90-nproc.conf file.to read:

```
# Default limit for number of user's processes to prevent
# accidental fork bombs.
# See rhbz #432903 for reasoning.

*               soft        nproc       65536
```

and reboot the computer or run init.

Appendix B
Science Processing Algorithm Execution List

The drl/ncs/configs/default_config.file configuration file lists those Science Processing Algorithm (SPA) stations selected for execution. This file is used for controlling the IPOPP Services and obtaining their status. A configuration example is shown in Figure B-1. Text between a "#" and the following end-of-line is considered a comment. Text delimited by white space is considered the name of an SPA station.

The default_config.file, as in the example, initially only enables the Level-0 to Level-1 SPAs (l0l1aqua, l0l1terra, l1atob and gbad); all Level-2 SPAs are commented and therefore disabled.

To enable an existing SPA, edit the configuration file and remove the "#" preceding the SPA name. Do not remove the "#" from lines beginning as "# ---". Remember that each enabled SPA increases the system resource load.

To add a new SPA, locate the CS Station subdirectory found in the $HOME/drl/SPA/*SPA_NAME*/station/ subdirectory of the newly installed SPA. Add this name to the default_config.file. The name should follow after the names of requisite ancestor products.

Generally the configuration file groups products in the required order of generation to make dependencies more obvious; dependencies are also noted in comments. In the example:

```
# ---Normalized Difference Vegetation Index
# ---(ndvievi requires crefl, geotiff requires firedetect)
#ndvievi
#ndvi-geotiff
```

the ndvi-geotiff product requires output from the ndvievi and firedetect products. The ndvievi product requires output from crefl. Level-0 and Level-1 product dependencies are not noted; these lower-level SPAs are enabled by default.

The currently available SPAs are included in this IPOPP software package and are listed in the configuration file. New and updated SPAs will be publicly available from the DRL Web Portal at: http://directreadout.sci.gsfc.nasa.gov Instructions for adding new SPAs are contained in the "Installing New SPAs" section of this document. Figure B-1 provides a configuration example.

NOTE: MOD09_SPA is not included with the IPOPP Version 1.7a distribution.

```
# ---NCS Station Selection File
# ---Select Science Processing Algorithms (SPAs) by removing "#"
# ---Do not remove "#" from comment lines.

# ---MODISL1DB --- (Do not disable)
l0l1aqua
l0l1terra
l1atob

# ---Ground Based Attitude Determination (Do not Disable)
gbad

# --- L2GEN Ocean Color
#chlor_a
#chlor_a-geotiff

# ---MODIS Corrected Reflectance
#crefl

# --- MODIS Active Fire Product (MOD14)
#mod14
#fire-geotiff

# --- International MODIS/AIRS Processing Package
# --- (uncomment IMAPP SPA and xxx-geotiff files)
#IMAPP IMAPP-Cloudtop aerosols-geotiff atmprofile-geotiff cloudmask-geotiff
#ctp-geotiff irphase-geotiff

# ---MODIS Land Surface Temperature (LST)
# --- (lst-geotiff requires firedetect)
#MODLST
#lst-geotiff

# ---Normalized Difference Vegetation Index
# ---(ndvievi requires crefl, geotiff requires firedetect)
#ndvievi
#ndvi-geotiff
#evi-geotiff

# ---L2GEN Sea Surface Temperature
#sst
#sst-geotiff

# --- CREFL True Color (needs crefl)
#creflrgb-geotiff
# ---(creflrgbfire-geotiff requires mod14)
#creflrgbfire-geotiff

# --- MOD09 Surface Reflectance
#mod09
```

Figure B-1. Example Configuration File

Appendix C
Receiver Interface to IPOPP

The Production Data Set (PDS) (packet file and Construction Record [CSR]) file pair(s) are entered into the IPOPP by placing them in the /raid/dsm/nisfes_data subdirectory on the Front End System (FES). The DSM PdsMover agent polls this subdirectory for CSR files. When PdsMover finds a CSR file, it performs preliminary processing and validation before transferring the packet and CSR file pair to the IS Data Repository and registering the files with the DSM. If the validation or the transfer fails, then the files are moved to the /raid/dsm/nisfes_data/FAIL subdirectory. Generally, the receiving system places the files in the nisfes_data subdirectory.

NOTE: The large packet file must be transferred to the /raid/dsm/nisfes_data subdirectory before the smaller CSR file is written to the same subdirectory. This order reduces the possibility of PdsMover transferring an incompletely written file.

Alternatively, the packet and CSR file pair may be copied in any order to /raid/dsm/nisfes_data as files named with suffixes other than PDS so that they are not recognized by PdsMover. The files can then be renamed with the proper suffixes.

To test the interface, first start the SLS to monitor the IPOPP. See Appendix D, "Status/Event Logging System." Then copy a packet and CSR file pair to /raid/dsm/nisfes_data/.

In more detail, the interface may be tested by manually copying a current Terra MODIS packet and CSR file pair from the DRL IS Data Repository to the local /raid/dsm/nisfes_data/ subdirectory. The Terra MODIS FTP URL is:

ftp://is.sci.gsfc.nasa.gov/gsfcdata/terra/modis/level0/

The rightmost numeric digit in packet file names is a "1". The corresponding CSR file is identically named excepting the rightmost numeric digit is a "0". By example:

P0420064AAAAAAAAAAAAAA07317165921001.PDS is a MODIS packet file, and,

P0420064AAAAAAAAAAAAAA07317165921000.PDS is a MODIS CSR file.

An FTP transfer in the above order of similar files selected from the DRL repository to the FES /raid/dsm/nisfes_data subdirectory on a running IPOPP host starts product generation.

To generate Aqua Spacecraft products, the GBAD packet file and CSR file must be transferred before the MODIS packet file and CSR file, as in the following example:

ftp://is.sci.gsfc.nasa.gov/gsfcdata/aqua/gbad/

P1540957AAAAAAAAAAAAAA07318174251001.PDS
P1540957AAAAAAAAAAAAAA07318174251000.PDS

ftp://is.sci.gsfc.nasa.gov/gsfcdata/aqua/modis/level0/

P1540064AAAAAAAAAAAAAA07318174251001.PDS
P1540064AAAAAAAAAAAAAA07318174251000.PDS

Appendix D
Status/Event Logging System (SLS)

The Status/Event Logging System (SLS) logs status and event messages sent by the IPOPP components. It is the primary system monitoring and diagnostic tool and gives the first indication of system problems or anomalies. An example of the SLS Console is shown in Figure D-1.

The SLS Console displays logged messages. Messages can be viewed in real time or replayed from a selected time span. Message filters allow the display of selected messages.

Informational messages are displayed over a white background. Warning messages are displayed over a yellow background and error messages are displayed over a red background.

Error messages also include backtrace text, which can be displayed or written to a file for further analysis. See Figure D-2.

To run the SLS Console, enter $HOME/drl/nsls/bin/nsls-console.sh. The following section describes the SLS Console functions in more detail.

NOTE: Do not select the Processing Monitor from the SLS Console "File" pull-down menu. This unsupported option is under development and may cause the SLS Console to fail.

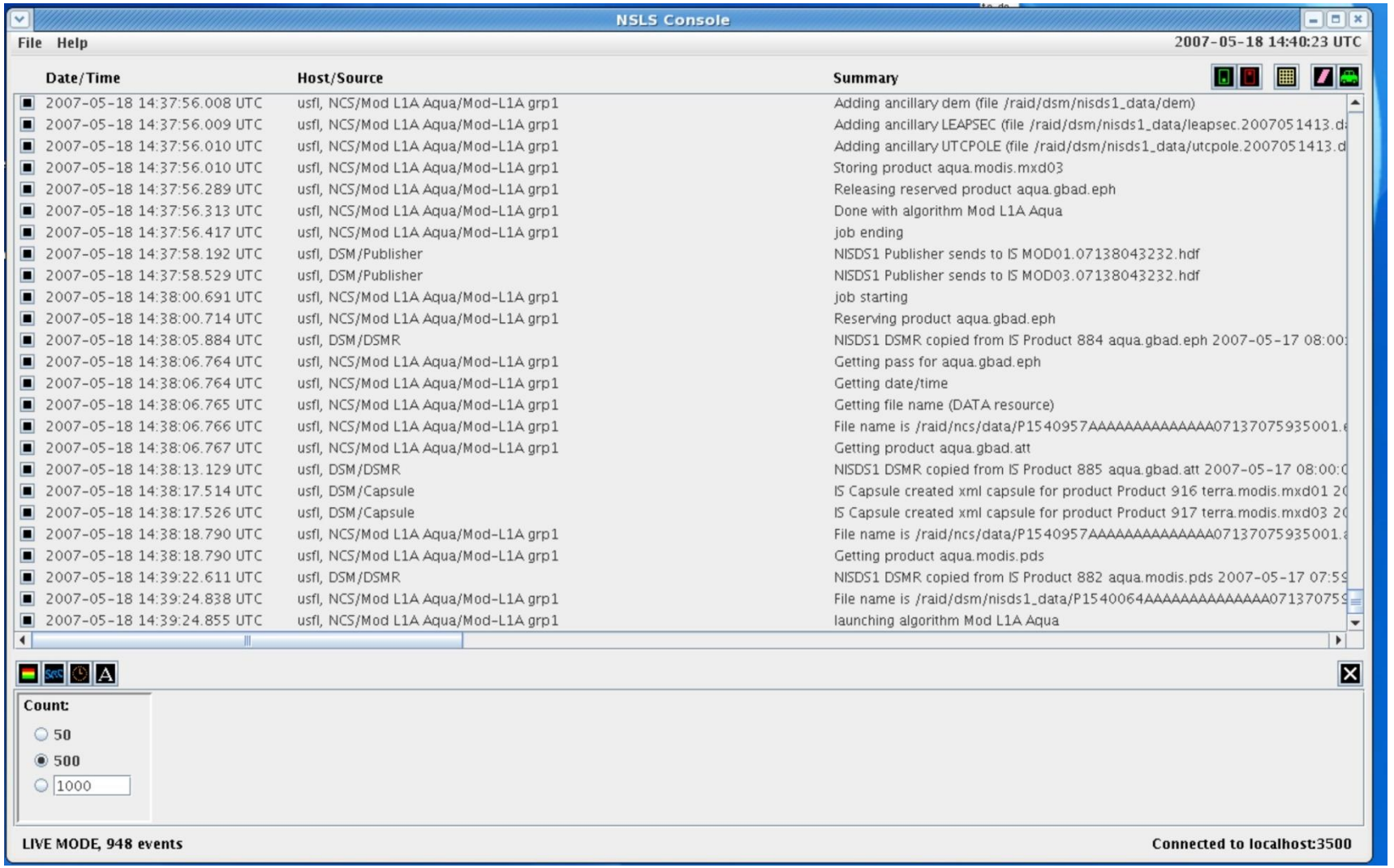


Figure D-1. SLS Console

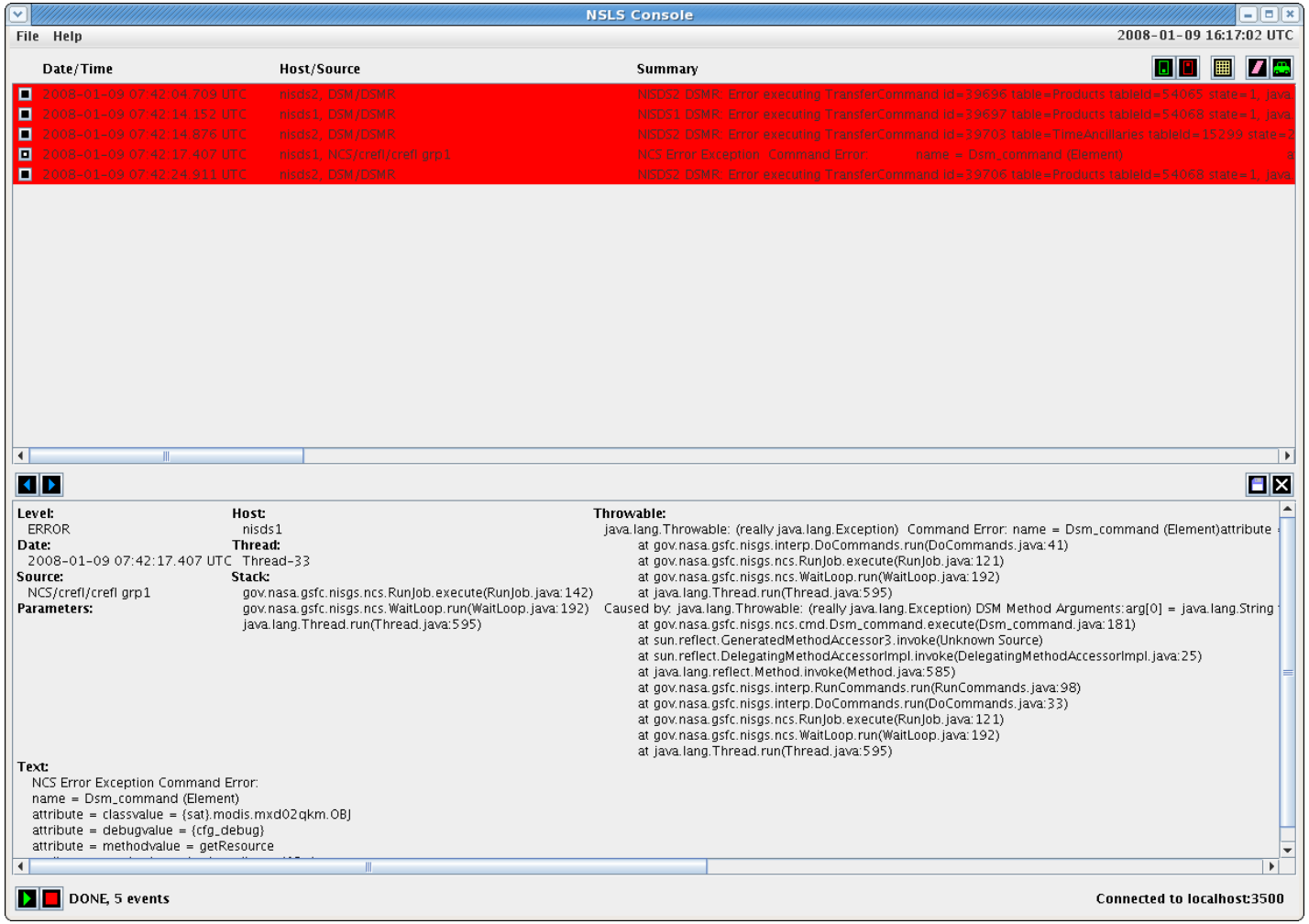


Figure D-2. Error Back Trace Text

The SLS Server Selection Window is invoked from the "File → Connect" dropdown menu to select the SLS Server to be displayed by the Console. See Figure D-3. The hostname:port may be entered by typing into the window or by choosing an entry from the dropdown menu. Generally, the selection should be "localhost:3500".

The "Select" button establishes the connection. The connection status is displayed in the lower right corner of the Console.

Figure D-3. Server Selection Window

The five Mode Control Buttons in the upper right hand corner of the display are shown in more detail in Figure D-4.

The Start LIVE Mode button displays messages as they are reported. The mode status is displayed in the lower left corner of the Console.

The Stop LIVE Mode button allows messages to be displayed for a selected time span. This button opens the Playback Controls shown in Figure D-5. The mode status is displayed in the lower left corner of the Console.

The Display Filter Panel button forces Message Filters to be displayed if they are hidden.

The Erase Events button deletes displayed messages.

The Toggle Auto-Scrolling of Events button starts and stops automatic message scrolling.

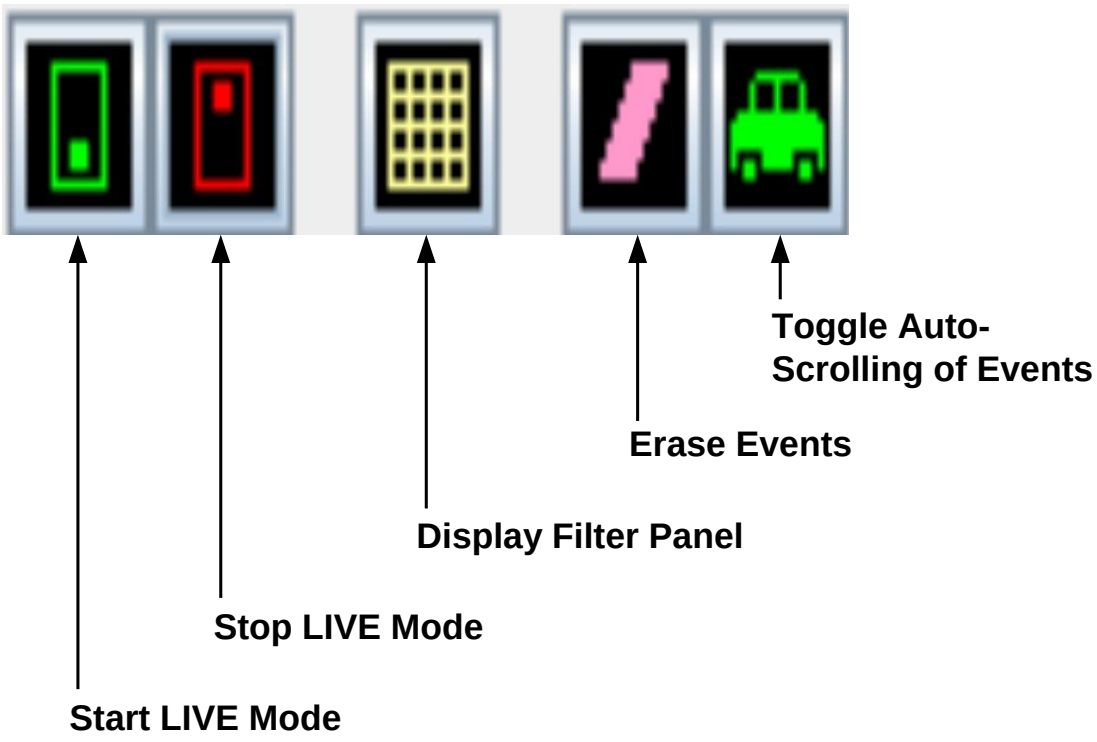


Figure D-4. Mode Control Buttons in Upper Right of Display

The Playback Control buttons are displayed in the lower left window corner when the SLS is in Playback Mode. See Figure D-5.

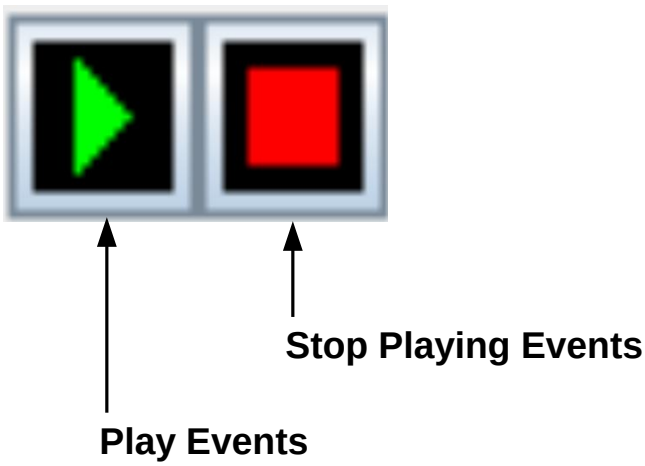


Figure D-5. Playback Controls

The four Message Filters serially select a subset of all messages for display. The filters are invoked by clicking on the buttons shown in Figure D-6. Each button opens a separate window where the selection criteria are specified.

The Display Level Filter button allows message selection by Information, Warning, and Error message levels.

The Display Source Filter button allows selection of messages by IPOPP component origin. The DSM, CS, IS and other components may be specified.

The Display Date/Time Filter constrains the display of messages to a specifiable time span.

The Display Text Filter allows only those messages containing a specifiable text string to be displayed.

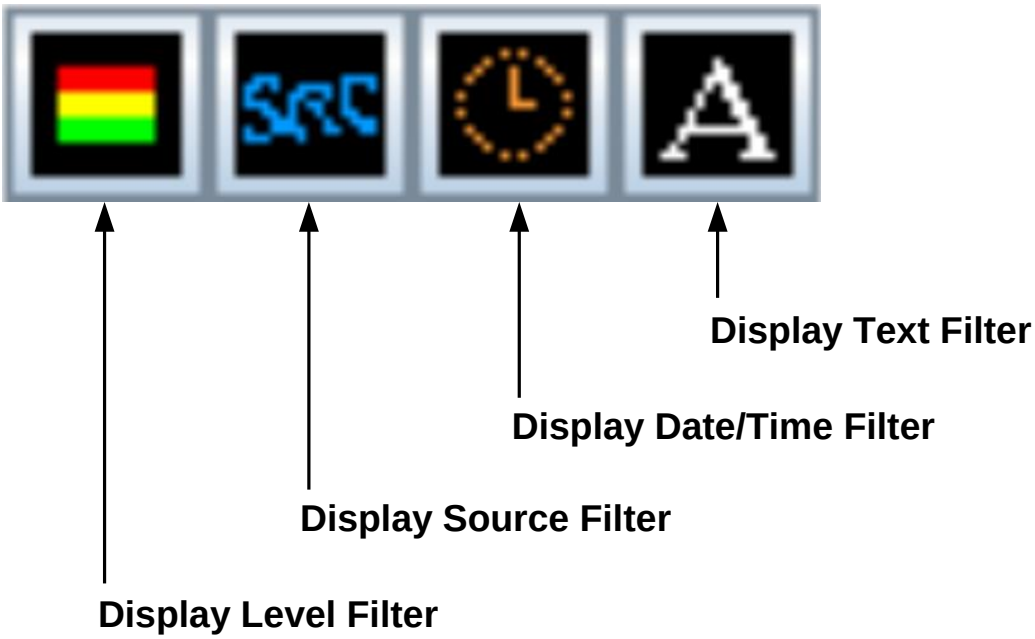


Figure D-6. Message Filters

The "Count" window selects three message scroll ranges. A large value captures more messages but requires more processing time, and makes the scroll bars more sensitive

Messages also include diagnostic back trace text, which can be displayed by clicking the Back Trace Button in the row displaying the message text. This creates a Back Trace Window containing the expanded text. See Figure D-7.

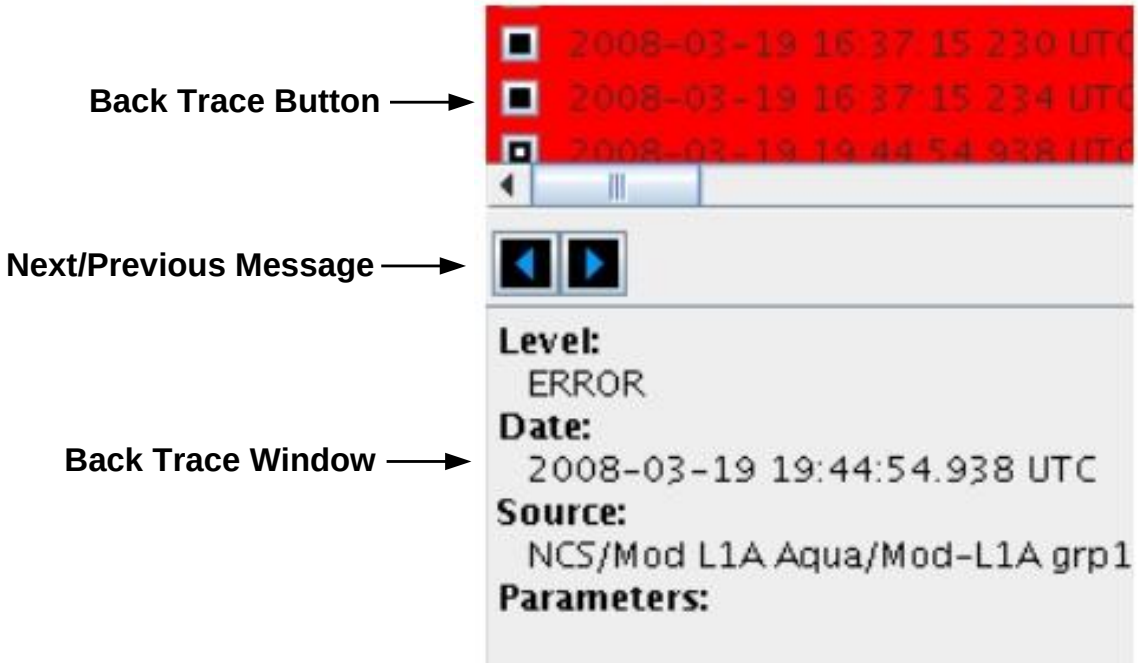


Figure D-7. Back Trace Details

The expanded text can be saved to a file by clicking on the Back Trace Save Button. Clicking on the Back Trace Window Delete Button deletes the backtrace text and restores the original display. See Figure D-8.

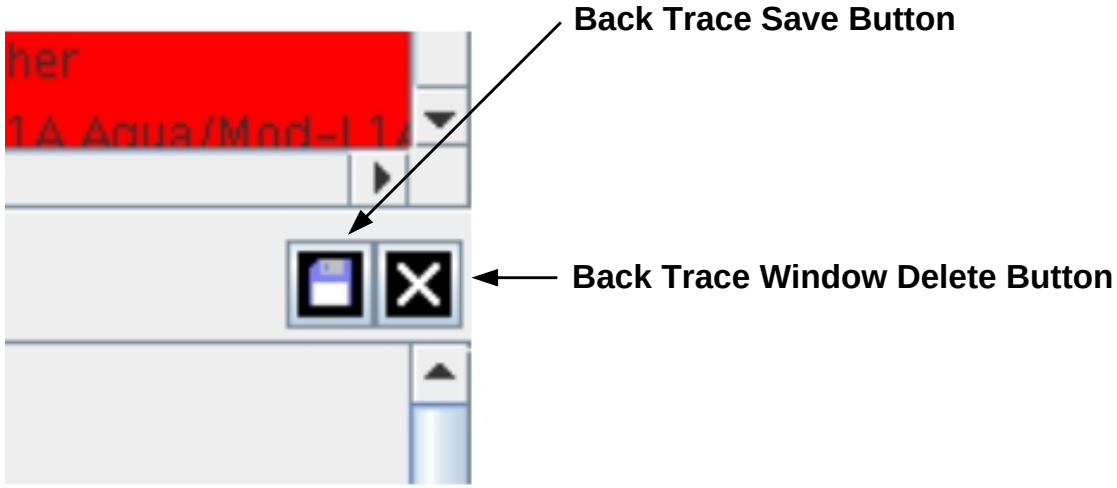


Figure D-8. Back Trace Save and Window Delete Buttons

Appendix E
Description of Science Processing Algorithms

A short description of the Science Processing Algorithms (SPAs) and other software included in this package follows. A more detailed description for some SPAs is contained in PDF documents located in the drl/SPA/*algorithm-name* subdirectories.

Aqua GBAD Ephemeris and Attitude Data Converter (GBAD)
GBAD reads Level-0 APID957 packet files and creates ephemeris and attitude files.

HDF to GeoTIFF (H2G)
The DRL provides the H2G utility for creating geotiff files from HDF products. TIFF viewers and Geographic Information Systems (GISs) can display these geotiff files.

International MODIS/AIRS Processing Package (IMAPP)
The IMAPP creates Level-2 MODIS Cloudmask (MOD35), Cloudtop Properties, Cloud Optical Properties, and Cloud Phase (MOD06), Atmospheric Profiles (MOD07), and Aerosol (MOD04) atmospheric products from MODIS Aqua and Terra Level-1B data.

MODIS Active Fire Product (MOD14)
MOD14 uses brightness temperatures derived from MODIS bands 21, 22 and 31 to detect fires, and MODIS bands 1, 2, 7 and 32 to reject false detection and to mask clouds. The algorithm reads a MODIS 1-km Level-1B file and the associated geolocation file, and generates a two-dimensional fire mask HDF file and optionally creates a text file listing the fire locations.

MODIS Land Surface Temperature (MODLST)
The LST algorithm uses brightness temperatures in MODIS bands 31 and 32 to produce day and night LST products at 1-km spatial resolutions in swath format. It uses MODIS Level-1B 1-km and geolocation HDF files and creates LST HDF files.

MODIS Level-1 Direct Broadcast Science Processing Algorithm (MODISL1DB)
MODISL1DB creates the Level-1A MOD01 and MYD01 HDF files, and MOD03 and MYD03 Geolocation products from MODIS Level-0 PDS packet and Construction Record (CSR) file pairs. Level-1B quarter, half and one kilometer resolution HDF files are created from the Level-1A products.

L2GEN Algorithm (L2GEN)
L2GEN produces MODIS Level-2 Ocean Color (daytime product, including Chlorophyll-a concentration) and Sea Surface Temperature (SST) products from

MODIS Level-1B 1km (MOD021KM and MYD021KM) products, MODIS Geolocation (MOD03 and MYD03) products, and other ancillary files.

Normalized Difference Vegetation Index (NDVIEVI)
The Normalized Difference Vegetation Index (NDVI)/Enhanced Vegetation Index (EVI) algorithm uses the three MODIS Level-1B files (1KM, HKM and QKM) and generates NDVI and EVI in a single HDF file. NDVI/EVI is a daytime-only product. The algorithm is applied on corrected reflectances in MODIS bands 1, 2 and 3.

MOD09
The surface reflectance product is an estimate of the surface spectral reflectance for each band as it would have been measured at ground level if there were no atmospheric scattering and absorption.

NOTE: MOD09 is resource-intensive; consideration should be given to system resources and hardware requirements of computers where this SPA is to run.

Appendix F
Information Services Repository Overview

The Information Services (IS) IS-Retriever acquires ancillary files required for product generation from remote sites and stores these files in the local IS Repository subdirectory. By default, ancillary files are retrieved from the DRL IS Repository. The IS-Deleter periodically traverses this subdirectory and deletes obsolete products and ancillary files.

IS Subdirectory Overview

All products and ancillary files are copied to the IS Repository. The highest-level subdirectory is /raid/pub. The following overview describes the main subdirectories. Not all subdirectories are currently populated.

/raid/pub/

Subdirectories under /raid/pub are:

isconfig/

IS-Retriever configuration files for real-time processing are stored in the isconfig/ subdirectory. These files are typically copied here by the SPA Installation Script.

isconfigReprocessing/

IS-Retriever Configuration Files for Archive Reprocessing are stored in the isconfigReprocessing/ subdirectory.

gsfcdata/

Locally generated Level-0, Level-1 and Level-2 products are stored here in the corresponding spacecraft subdirectories by instrument type.

terra/

aqua/

ancillary/

Ancillary files required for product generation but not created locally are stored in the ancillary/ subdirectory.

temporal/

This subdirectory contains time-dependent high-level products retrieved from remote sites, e.g. Sea Surface Temperature, Global Sea Ice Concentration, Total Ozone Analysis, etc.

LUTs/

Instrument Calibration and Lookup Tables (LUTs) retrieved from remote sites are stored here.

ephemeris/

Currently this subdirectory contains the tle/ subdirectory where NORAD Two-Line Element (TLE) Sets are stored.

ArchivedAncillary/
Ancillary files that have been archived out of the regular /raid/pub/ancillary subdirectory. Uses same subdirectory tree structure as /raid/pub/ancillary.

/raid/dsm/nisfes_data/

Level-0 packet and CSR files are input to the IPOPP by placing them in this subdirectory. See Appendix C, "Receiver Interface to IPOPP."

FAILED/

Files causing errors during initial processing by PdsMover are placed here.

SLIVERS/

Short files representing pass fragments are placed here.

Appendix G
IPOPP Software Package Overview

A top-level overview of the IPOPP Software Package directory structure is presented in Figure G-1.

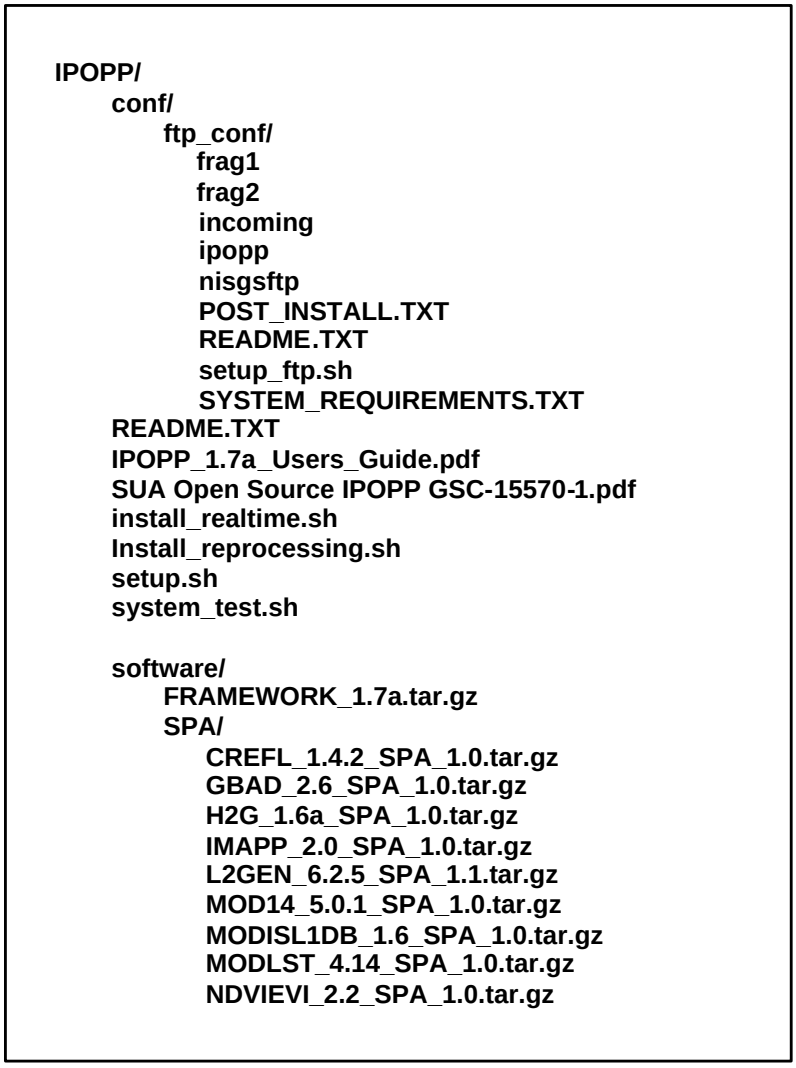


Figure G-1. Top-level IPOPP Software Package Hierarchy

The "software" subdirectory contains the SPAs, IPOPP software, and static data. Each SPA is stored as a compressed archive file in the SPA/ subdirectory. The FRAMEWORK_1.7a.tar.gz file contains the software.

The IPOPP_1.7a_Users_Guide.pdf is this User's Guide in Adobe PDF format. The README.TXT briefly identifies this package and lists DRL contacts.

The system_test.sh tests the host computer against many known software and hardware requirements. These requirements are listed in more detail in Appendix A, "System Requirements".

The "install_realtime.sh" and "install_reprocessing.sh" scripts are the main installation scripts. They invoke the "setup.sh" script, which calls auxiliary scripts in the "scripts" subdirectory to install the IPOPP in Real-time Processing Mode or Archive Reprocessing Mode. Detailed installation instructions are included in the "IPOPP Installation" section of this User's Guide.

Appendix H
Direct Readout Laboratory Archives

The Direct Readout Laboratory (DRL) maintains a publicly accessible ancillary file archive containing compressed TAR files in a single subdirectory. This archive resides on the DRL Information Services (IS) Repository and may be retrieved using FTP.

This archive is kept current by accessing the DRL IS Repository. The DRL takes reasonable measures to maintain database integrity, but cannot guarantee data quality or continuity.

The Compressed Archive is located in the DRL IS Repository, accessible by FTP:

is.sci.gsfc.nasa.gov:/CompressedArchivedAncillary/

Each file contains the entire archive spanning a period of 11 days. The file name format is: DRLAncillary_YYYY-MM-DD.tgz. By example:

```
CompressedArchivedAncillary/
...
DRLAncillary_2008-01-07.tgz      (spans 2008-01-07 thru 2008-01-17)
DRLAncillary_2008-01-17.tgz      (spans 2008-01-17 thru 2008-01-27)
…
```

To retrieve ancillary files from the remote Compressed Archive, first change to /raid/ on the local computer where the compressed tar files will be stored:

```
cd /raid/
```

Then use FTP to retrieve the ancillary files spanning the times of interest. By example:

```
ftp is.sci.gsfc.nasa.gov
Name xxx: anonymous
331 Please specify the password.
Password: xxx
…
cd CompressedArchivedAncillary
get DRLAncillary_2008-01-07.tgz
get DRLAncillary_2008-01-17.tgz
get DRLAncillary_2008-01-27.tgz
get DRLAncillary_2008-02-06.tgz…
...
ftp> quit
```

Extract the ancillary files from the tar files and expand the /raid/pub/ArchivedAncillary/ subdirectory as in this example:

```
   tar -C /raid/pub -xzf DRLAncillary_2008-01-07.tgz
   tar -C /raid/pub -xzf DRLAncillary_2008-01-17.tgz
…
```

Maintenance times when this archive should not be accessed will be announced periodically.

Appendix I
IPOPP Products

These DSM tables are representative of a typical IPOPP installation. The first table is a complete list of all product types that can be created by an IPOPP with all present SPAs installed.

The second and third tables are lists of products generated for Aqua and Terra passes, respectively, and contain typical file names for those products and their locations in the static tree.

IPOPP Products

algorithm (SPA)	IPOPP Product Type	Description
aerosols-geotiff	drl.aqua.modis.aerosols_aod.geotiff	IMAPP aerosols geotiff
aerosols-geotiff	drl.terra.modis.aerosols_aod.geotiff	IMAPP aerosols geotiff
atmprofile-geotiff	drl.terra.modis.atmprofile_tpw.geotiff	IMAPP Total Precipitable water geotiff
atmprofile-geotiff	drl.aqua.modis.atmprofile_tpw.geotiff	IMAPP Total Precipitable water geotiff
chlor_a	drl.aqua.modis.chlor_a	chlorophyll_a
chlor_a	drl.terra.modis.chlor_a	chlorophyll_a
chlor_a-geotiff	drl.terra.modis.chlor_a.geotiff	IMAPP Chlorophyll-a geotiff
chlor_a-geotiff	drl.aqua.modis.chlor_a.geotiff	IMAPP Chlorophyll-a geotiff
cloudmask-geotiff	drl.aqua.modis.cloudmask.geotiff	IMAPP Cloudmask geotiff
cloudmask-geotiff	drl.terra.modis.cloudmask.geotiff	IMAPP Cloudmask geotiff
crefl	drl.terra.modis.crefl	crefl
crefl	drl.aqua.modis.crefl	crefl
CREFL True Color	drl.terra.modis.crefl_rgb.geotiff	True Color geotiff
CREFL True Color	drl.aqua.modis.crefl_rgb.geotiff	True Color geotiff
CREFL True Color Fire	drl.aqua.modis.crefl_rgbfire.geotiff	True Color Fire geotiff
CREFL True Color Fire	drl.terra.modis.crefl_rgbfire.geotiff	True Color Fire geotiff
ctp-geotiff	drl.terra.modis.cloudtop_ctp.geotiff	IMAPP Cloudtop Pressure geotiff
ctp-geotiff	drl.aqua.modis.cloudtop_ctp.geotiff	IMAPP Cloudtop Pressure geotiff
evi-geotiff	drl.terra.modis.evi.geotiff	EVI geotiff
evi-geotiff	drl.aqua.modis.evi.geotiff	EVI geotiff
fire-geotiff	drl.terra.modis.fire.geotiff	Fire geotiff
fire-geotiff	drl.aqua.modis.fire.geotiff	Fire geotiff
gbad	drl.aqua.gbad_att	GBAD Attitude
gbad	drl.aqua.gbad_eph	GBAD Ephemeris
IMAPP	drl.terra.modis.cloudmask	IMAPP 48-bit cloud mask
IMAPP	drl.terra.modis.aerosols	IMAPP optical depth, coarse/fine
IMAPP	drl.aqua.modis.cloudmask	IMAPP 48-bit cloud mask
IMAPP	drl.aqua.modis.aerosols	IMAPP optical depth, coarse/fine
IMAPP	drl.terra.modis.atmprofile	IMAPP atmospheric profile
IMAPP	drl.aqua.modis.atmprofile	IMAPP atmospheric profile
IMAPP-Cloudtop	drl.terra.modis.cloudtop	IMAPP Cloudtop properties
IMAPP-Cloudtop	drl.aqua.modis.cloudtop	IMAPP Cloudtop properties
irphase-geotiff	drl.aqua.modis.cloudtop_irphase.geotiff	IMAPP Cloudtop IRphase geotiff
irphase-geotiff	drl.terra.modis.cloudtop_irphase.geotiff	IMAPP Cloudtop IRphase geotiff
lst	drl.terra.modis.landst	land surface temperature
lst	drl.aqua.modis.landst	land surface temperature
lst-geotiff	drl.terra.modis.landst.geotiff	LST geotiff
lst-geotiff	drl.aqua.modis.landst.geotiff	LST geotiff
Mod L1A Aqua	drl.aqua.modis.mxd03	Geolocated Granule
Mod L1A Aqua	drl.aqua.modis.mxd01	MYD01 Granule
Mod L1A Terra	drl.terra.modis.mxd01	MOD01 Granule
Mod L1A Terra	drl.terra.modis.mxd03	Geolocated Granule
Mod L1B	drl.aqua.modis.mxd021km	MYD02 1 km Granule
Mod L1B	drl.terra.modis.mxd02qkm	MOD02 1/4 km Granule
Mod L1B	drl.aqua.modis.mxd02qkm	MYD02 1/4 km Granule
Mod L1B	drl.terra.modis.mxd02hkm	MOD02 1/2 km Granule
Mod L1B	drl.aqua.modis.mxd02hkm	MYD02 1/2 km Granule
Mod L1B	drl.terra.modis.mxd021km	MOD02 1 km Granule

IPOPP Products (continued)

algorithm (SPA)	IPOPP Product Type	Description
MOD14	drl.aqua.modis.firedetection	MYD014 Fire Detection
MOD14	drl.terra.modis.fireloc.txt	MOD14 Fire Locations
MOD14	drl.aqua.modis.fireloc.txt	MYD14 Fire Locations
MOD14	drl.terra.modis.firedetection	MOD014 Fire Detection
ndvi	drl.terra.modis.ndvi	MOD013 Normalized Vegetation Index
ndvi	drl.aqua.modis.ndvi	MYD013 Normalized Vegetation Index
ndvi-geotiff	drl.terra.modis.ndvi.geotiff	NDVI geotiff
ndvi-geotiff	drl.aqua.modis.ndvi.geotiff	NDVI geotiff
rtstps	drl.aqua.0141.pds	ceres 141 pds
rtstps	drl.aqua.0414.pds	airs 414 pds
rtstps	drl.aqua.modis.pds	modis pds
rtstps	drl.aqua.0405.pds	airs 405 pds
rtstps	drl.aqua.0342.pds	hsb 342 pds
rtstps	drl.aqua.0261.pds	amsu 261 pds
rtstps	drl.aqua.gbad.pds	gbad pds
rtstps	drl.aqua.0407.pds	airs 407 pds
rtstps	drl.aqua.0404.pds	airs 404 pds
rtstps	drl.aqua.0290.pds	amsu 290 pds
rtstps	drl.aqua.0157.pds	ceres 157 pds
rtstps	drl.aqua.0415.pds	airs 415 pds
rtstps	drl.aqua.0406.pds	airs 406 pds
rtstps	drl.terra.modis.pds	modis pds
rtstps	drl.aqua.0402.pds	amsr 402 pds
rtstps	drl.aqua.0262.pds	amsu 262 pds
sst	drl.terra.modis.sst	Sea Surface Temperature
sst	drl.aqua.modis.sst	Sea Surface Temperature
sst-geotiff	drl.terra.modis.sst.geotiff	IMAPP SST geotiff
sst-geotiff	drl.aqua.modis.sst.geotiff	IMAPP SST geotiff

Aqua Product Generation Example

algorithm (SPA)	IPOPP Product Type	/raid/pub/	Example File Name
atmprofile-geotiff	drl.aqua.modis.atmprofile_tpw.geotiff	gsfcdata/aqua/modis/level2	PROFILES.09278164720.TPW.tif
chlor_a	drl.aqua.modis.chlor_a	gsfcdata/aqua/modis/level2	CHLOR_A.09278164720.hdf
chlor_a-geotiff	drl.aqua.modis.chlor_a.geotiff	gsfcdata/aqua/modis/level2	CHLOR_A.09278164720.tif
cloudmask-geotiff	drl.aqua.modis.cloudmask.geotiff	gsfcdata/aqua/modis/level2	CLOUDMASK.09278164720.tif
crefl	drl.aqua.modis.crefl	gsfcdata/aqua/modis/level2	MYDcrefl.09278164720.hdf
CREFL True Color	drl.aqua.modis.crefl_rgb.geotiff	gsfcdata/aqua/modis/level2	MYDcrefl_TrueColor.09278164720.tif
ctp-geotiff	drl.aqua.modis.cloudtop_ctp.geotiff	gsfcdata/aqua/modis/level2	CLOUDTOP.09278164720.CTP.tif
evi-geotiff	drl.aqua.modis.evi.geotiff	gsfcdata/aqua/modis/level2	MYD13.09278164720.EVI.tif
fire-geotiff	drl.aqua.modis.fire.geotiff	gsfcdata/aqua/modis/level2	MYD14.09278164720.tif
gbad	drl.aqua.gbad_att	gsfcdata/aqua/gbad	P1540957AAAAAAAAAAAAAA09278164645001.att
gbad	drl.aqua.gbad_eph	gsfcdata/aqua/gbad	P1540957AAAAAAAAAAAAAA09278164645001.eph
IMAPP	drl.aqua.modis.atmprofile	gsfcdata/aqua/modis/level2	PROFILES.09278164720.hdf
IMAPP	drl.aqua.modis.cloudmask	gsfcdata/aqua/modis/level2	CLOUDMASK.09278164720.hdf
IMAPP-Cloudtop	drl.aqua.modis.cloudtop	gsfcdata/aqua/modis/level2	CLOUDTOP.09278164720.hdf
irphase-geotiff	drl.aqua.modis.cloudtop_irphase.geotiff	gsfcdata/aqua/modis/level2	CLOUDTOP.09278164720.IRPHASE.tif
lst	drl.aqua.modis.landst	gsfcdata/aqua/modis/level2	LST.09278164720.hdf
lst-geotiff	drl.aqua.modis.landst.geotiff	gsfcdata/aqua/modis/level2	LST.09278164720.tif
Mod L1A Aqua	drl.aqua.modis.mxd01	gsfcdata/aqua/modis/level1	MYD01.09278164720.hdf
Mod L1A Aqua	drl.aqua.modis.mxd03	gsfcdata/aqua/modis/level1	MYD03.09278164720.hdf
Mod L1B	drl.aqua.modis.mxd021km	gsfcdata/aqua/modis/level1	MYD021KM.09278164720.hdf
Mod L1B	drl.aqua.modis.mxd02qkm	gsfcdata/aqua/modis/level1	MYD02QKM.09278164720.hdf
Mod L1B	drl.aqua.modis.mxd02hkm	gsfcdata/aqua/modis/level1	MYD02HKM.09278164720.hdf
MOD14	drl.aqua.modis.firedetection	gsfcdata/aqua/modis/level2	MYD14.09278164720.hdf
ndvi	drl.aqua.modis.ndvi	gsfcdata/aqua/modis/level2	MYD13.09278164720.hdf
ndvi-geotiff	drl.aqua.modis.ndvi.geotiff	gsfcdata/aqua/modis/level2	MYD13.09278164720.NDVI.tif
sst	drl.aqua.modis.sst	gsfcdata/aqua/modis/level2	SST.09278164720.hdf
sst-geotiff	drl.aqua.modis.sst.geotiff	gsfcdata/aqua/modis/level2	SST.09278164720.tif

Terra Product Generation Example

algorithm (SPA)	IPOPP Product Type	/raid/pub/	Example File Name
atmprofile-geotiff	drl.terra.modis.atmprofile_tpw.geotiff	gsfcdata/terra/modis/level2	PROFILES.09275174401.TPW.tif
chlor_a	drl.terra.modis.chlor_a	gsfcdata/terra/modis/level2	CHLOR_A.09275174401.hdf
chlor_a-geotiff	drl.terra.modis.chlor_a.geotiff	gsfcdata/terra/modis/level2	CHLOR_A.09275174401.tif
cloudmask-geotiff	drl.terra.modis.cloudmask.geotiff	gsfcdata/terra/modis/level2	CLOUDMASK.09275174401.tif
crefl	drl.terra.modis.crefl	gsfcdata/terra/modis/level2	MODcrefl.09275174401.hdf
CREFL True Color	drl.terra.modis.crefl_rgb.geotiff	gsfcdata/terra/modis/level2	MODcrefl_TrueColor.09275174401.tif
ctp-geotiff	drl.terra.modis.cloudtop_ctp.geotiff	gsfcdata/terra/modis/level2	CLOUDTOP.09275174401.CTP.tif
evi-geotiff	drl.terra.modis.evi.geotiff	gsfcdata/terra/modis/level2	MOD13.09275174401.EVI.tif
fire-geotiff	drl.terra.modis.fire.geotiff	gsfcdata/terra/modis/level2	MOD14.09275174401.tif
IMAPP	drl.terra.modis.cloudmask	gsfcdata/terra/modis/level2	CLOUDMASK.09275174401.hdf
IMAPP	drl.terra.modis.atmprofile	gsfcdata/terra/modis/level2	PROFILES.09275174401.hdf
IMAPP-Cloudtop	drl.terra.modis.cloudtop	gsfcdata/terra/modis/level2	CLOUDTOP.09275174401.hdf
irphase-geotiff	drl.terra.modis.cloudtop_irphase.geotiff	gsfcdata/terra/modis/level2	CLOUDTOP.09275174401.IRPHASE.tif
lst	drl.terra.modis.landst	gsfcdata/terra/modis/level2	LST.09275174401.hdf
lst-geotiff	drl.terra.modis.landst.geotiff	gsfcdata/terra/modis/level2	LST.09275174401.tif
Mod L1A Terra	drl.terra.modis.mxd01	gsfcdata/terra/modis/level1	MOD01.09275174401.hdf
Mod L1A Terra	drl.terra.modis.mxd03	gsfcdata/terra/modis/level1	MOD03.09275174401.hdf
Mod L1B	drl.terra.modis.mxd02hkm	gsfcdata/terra/modis/level1	MOD02HKM.09275174401.hdf
Mod L1B	drl.terra.modis.mxd021km	gsfcdata/terra/modis/level1	MOD021KM.09275174401.hdf
Mod L1B	drl.terra.modis.mxd02qkm	gsfcdata/terra/modis/level1	MOD02QKM.09275174401.hdf
MOD14	drl.terra.modis.firedetection	gsfcdata/terra/modis/level2	MOD14.09275174401.hdf
ndvi	drl.terra.modis.ndvi	gsfcdata/terra/modis/level2	MOD13.09275174401.hdf
ndvi-geotiff	drl.terra.modis.ndvi.geotiff	gsfcdata/terra/modis/level2	MOD13.09275174401.NDVI.tif
sst	drl.terra.modis.sst	gsfcdata/terra/modis/level2	SST.09275174401.hdf
sst-geotiff	drl.terra.modis.sst.geotiff	gsfcdata/terra/modis/level2	SST.09275174401.tif